*User's manual*

# W500H/H4
# W500HMB/HMB4

CE


Temperature and humidity controller




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ISO9000

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# INTRODUCTION

The temperature and relative humidity controller for AHU is provided with four control loops, two analogue with 0-10Vdc output loops and two on/off hysteresis with relay output loops with exchange contact.
All loops have independent control parameters and set points.
All the four loops share the three sensors (control, compensation and limit) coming from:

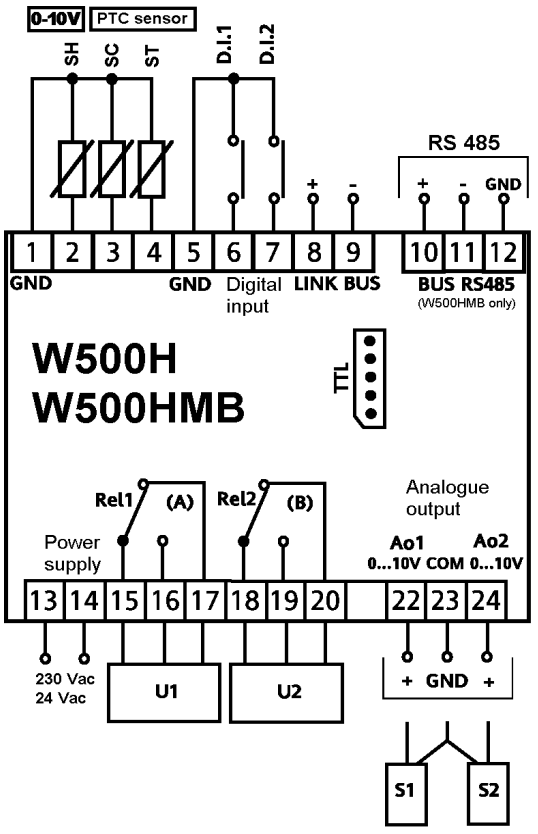
- **ST** temperature control sensor
- **SC** compensation sensor
- Relative humidity sensor, **SH** limit and/or compensation

The controller is also provided with two digital dry-contact inputs which can be used for outside enable or summer/winter changeover functions.
Each loop can control its own output independently from the other using four different operating modes.
The controller is characterized by a user interface composed of a 3 ½ digit FND display, of five buttons and of twelve LEDs located on the front membrane.
Data on display depend on sensor presence and on enabling the various functions.
The controller is also provided with a two-wire local bus called “LinkBus”
Through the local bus port it is possible to connect up to 4 different devices with other devices of the same W digital series with the purpose to share the sensor and the operating mode.
The local bus also allows the W500H to be supervised if at least one W500TMB or W500HMB is connected.
The W500HMB version differs from the basic W500H for its on-board RS485 ModBus communication interface and for the real time clock with daily and weekly schedules.
The W500HMB allows supervision for itself and for the other W500H or W500T devices (max 3) connected to it through a LinkBus and shares with them the set time schedules.

**NOTE: A pressure sensor on the analogue loop 2 or digital loop 2 can be used in place of the humidity sensor.**

**Electrical connections:**

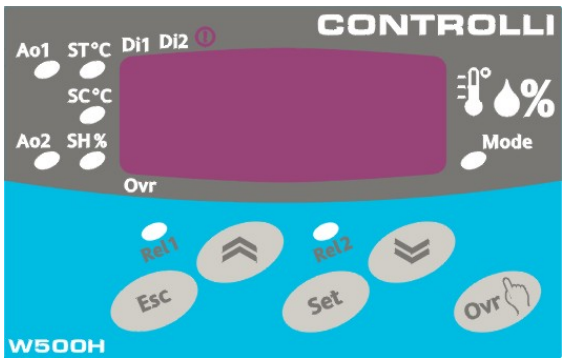
| | | | | |
|---|---|---|---|---|
| **1** | **GND** | | **13** | **230 Vac F (W500H/HMB) or 24 Vac F (W500H4/HMB4)** |
| **2** | **SH** | | **14** | **230 Vac N (W500H/HMB) or 24 Vac N (W500H4/HMB4)** |
| **3** | **SC** | | **15** | **Rel 1 CO** |
| **4** | **ST** | | **16** | **Rel 1 NA** |
| **5** | **GND** | | **17** | **Rel 1 NC** |
| **6** | **Di1** | | **18** | **Rel 2 CO** |
| **7** | **Di2** | | **19** | **Rel 2 NA** |
| **8** | **LinkBus +** | | **20** | **Rel 2 NC** |
| **9** | **LinkBus -** | | | |
| **10** | **Bus 485 +** | | **22** | **Ao1** |
| **11** | **Bus 485 –** | **W500HMB** | **23** | **GND** |
| **12** | **GND 485** | **ONLY** | **24** | **Ao2** |




Legend:
**ST**: PTC temperature control sensor
**SC**: PTC outside compensation sensor
**SH**: 0-10Vcc humidity control sensor
**U1**: User 1 (ex. Fan, circulation pump, on/off valve, etc.)
**U2**: User 2 (ex. on/off humidifier, on/off damper, etc.)
**S1**: 0 – 10 Volt proportional actuator
**S2**: 0 – 10 Volt proportional actuator

## USER INTERFACE

The device is characterized by a user interface composed of a 3 ½-digit FND display, five keys and twelve LEDs located on the front membrane. The information displayed on screen depends on whether the sensors are present or not and on the related function enable. Using the buttons it is possible to navigate a cascade menu, which allows configuring individually the functions to be assigned to the 4 independent outputs.




Description of keys

Button **Up** to increase values.
Used both for parameter modification and for moving inside the menus.

Button **Down** to decrease values.
Used both for parameter modification and for moving inside the menus.

Esc — Cancel and menu exit

Set — Parameter programming and confirmation

Ovr — Operating mode override

Led description

| | |
|---|---|
| **Ao1** | Led associated to analogue output 1, it is on during data display. |
| **Ao2** | Led associated to analogue output 2, it is on during data display. |
| **ST** | Led associated to temperature control sensor value. |
| **SC** | Led associated to compensation sensor value. |
| **SH** | Led associated to humidity sensor value. |
| **DI1** | Led associated to digital input 1, it is on when the input is active (closed contact). |
| **DI2** | Led associated to digital input 2, it is on when the input is active (closed contact). |
| **Rel1** | Led associated to relay output 1, it is on when the output is active. |
| **Rel2** | Led associated to relay output 2, it is on when the output is active. |
| ⓘ | Led associated to anomaly signal. |
| **Ovr** | Led associated to override status of *Operating mode* |
| **Mode** | Led associated to *Operating mode*.<br>On — Comfort<br>Blinking — Reduced<br>Off — Stop |

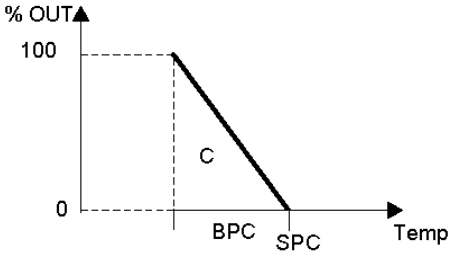
# FUNCTION DESCRIPTION

## *GENERAL*

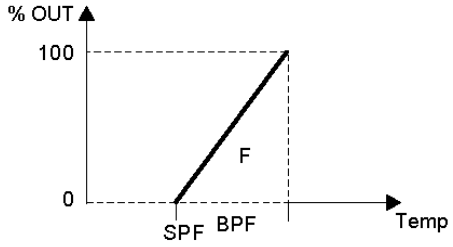
First of all it is necessary to establish the operating mode for each control loop.
The operating mode is the function to be assigned to a specific output. The output of each loop depends on the sensor which carries out control.
For the A1 and D1 loops it is possible to set temperature sensor **ST**, whilst for A2 and D2 loops it is possible to set either relative humidity sensor or enthalpy sensor (temperature only or both temperature and humidity; in the latter case two controllers are needed).
A1 and D1 loops control temperature sensor **ST** for Ao1 and Rel1 outputs.
Heating control means that the output moves in an inversely proportional way with respect to the value measured by the temperature sensor, vice versa is the meaning of cooling control.
Operating modes are:

## FOR ANALOGUE OUTPUT 1 IT IS POSSIBLE TO SELECT:

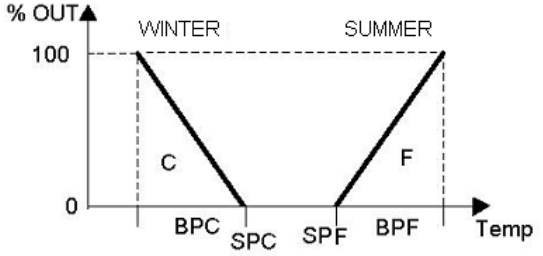
MODE A1: HEATING LOOP
If the output value has to increase when the control sensor value drops under the operating set.
When the set point is achieved the output is zero.
If the control temperature drops under the SPC Heating Set Point minus BPC Heating Proportional Band the relevant analogue output goes to 100% equivalent to 10 Vdc.



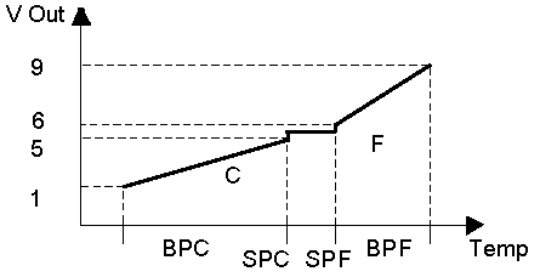

MODE A2: COOLING LOOP
If the output value has to increase when the control sensor value exceeds the operating set.
When the set-point is achieved the output is zero.
If the control temperature goes above the SPF Cooling Set point plus BPF Cooling Proportional Band the relevant analogue output goes to 100% equivalent to 10 Vdc.




MODE A3: HEATING / COOLING LOOP FROM S/W CHANGEOVER
If the Heating or Cooling Loop is enabled through the contact input (D.i.2) in order to carry out a season changeover. When the D.i.2 contact is open, the Loop passes to “Heating” control type; under closed contact the Loop passes to “Cooling” control type. The two “Set” (SPC, SPF) and the two proportional bands (BPC, BPF) are independent.




MODE A4: HEATING LOOP / COOLING IN SEQUENCE
If it is required to exploit the 0-5 6-10 V control characteristic of CONTROLLI actuators to realize a Heating Cooling sequence with a unique 0–10 Vdc analogue output. When the set point is achieved the output is 5,5 Vdc. If the control Temperature goes below the Heating Set Point value (SPC) minus Heating Proportional Band (BPC), the relevant analogue output goes to 0 Vdc. If the control Temperature goes above the value the Cooling Set Point value (SPF) plus Cooling Proportional Band (BPF) the relevant analogue output goes to 10 Vdc.

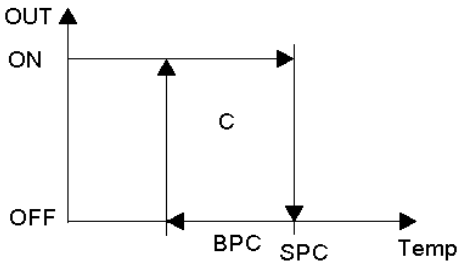



In this case, if a heating-Cooling sequence is required, the two actuators must be connected in parallel to the same output selecting the range 0 – 5 Vdc with reverse action for the actuator, which manages the heating channel, while for the actuator managing the Cooling channel, it is necessary to select the range 6 – 10 Vdc with direct action.

## FOR THE 1 ON/OFF DIGITAL RELAY OUTPUT IT IS POSSIBLE TO SELECT:

MODE D1: ON/OFF HEATING HYSTERESIS

If the output value must turn to ON when the value of the Control Sensor goes below the Operating Set minus the Hysteresis band.
When the set point is achieved, the relay output is OFF.

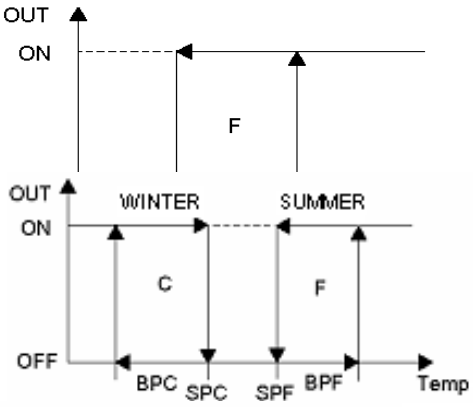



MODE D2: ON/OFF COOLING HYSTERESIS

If the output value must turn to ON when the control sensor value goes above the Operating Set plus the Hysteresis band. When the Set Point is achieved, the relay output is OFF.

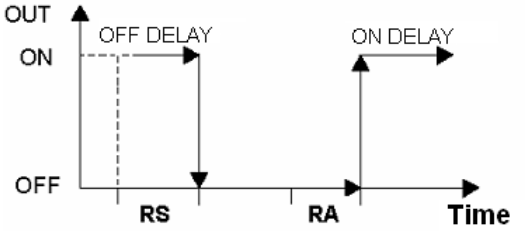
MODE D3: HEATING/COOLING HYSTERESIS FROM S/W CHANGEOVER

If it is required to enable the heating or cooling hysteresis through the contact input (D.i.2) to carry out a season changeover. When the D.i.2 contact is open, the Loop passes to "Heating" control type; under closed contact the Loop passes to "Cooling" control type.
The two "Set" (SPC, SPF) and the two proportional bands (BPC, BPF) are independent.




MODE D4: ON/OFF DELAY

If it is required to enable or disable a relay output with a specified delay at stop and/or start.
The delay is considered with respect to an event, which can be:




- Operating Mode (NM and RF => ON, FA => OFF), if a stop and/or start delay of a device following the Operating Mode is required.
- The status of one of the two digital inputs (D.i.1 or D.i.2), if it is required a stop and/or start delay of a device following the status of one or both dry contact inputs.
- The status of the other Relay output, if it is required a stop and/or start delay of a device following the status of the other digital relay output.

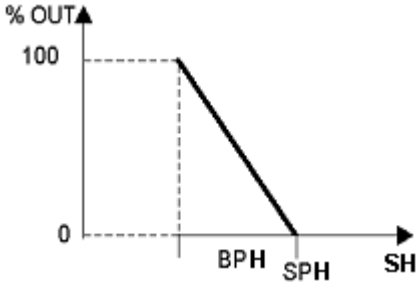
The ON Delay **(RA)** and the Off Delay **(RS)** can be set individually in seconds.
The events generating the changeover are according to an "OR" logic, which means that, if more than one event condition is enabled, it is sufficient that only one is true.
The maximum allowed delay is 30 minutes.

A2 and D2 loops control, for the Ao2 and Rel2 outputs, the SH humidity sensor only through the operating modes A1, A2 and A4, whilst in the operating mode A3 they control enthalpy only in temperature or complete enthalpy (temperature and humidity) if the outdoor humidity signal through LinkBus is supplied (see page 15).

## FOR ANALOGUE OUTPUT 2 IT IS POSSIBLE TO SELECT:

Mode A1: HUMIDITY LOOP

If the output value must increase when the **SH** Humidity Sensor value drops under the set point. When the set point is achieved, the output is zero. If the SH Humidity Sensor value drops under the SPH Humidity Set point minus BPH Humidity Proportional Band, the relevant analogue output goes to 100% equivalent to 10Vdc.



MODE A2 DEHUMIDIFICATION LOOP

If the output value must increase when the **SH** Humidity Sensor value goes above the operating set. When the set point is achieved the output is zero.

If the **SH** Humidity Sensor value exceeds the SPD Dehumidification Set Point value plus BPD Dehumidification Proportional Band, the relevant analogue output goes to 100% equivalent to 10Vdc.

MODE A3 ENTHALPY CONTROL WITH SUMMER/WINTER CHANGEOVER SET

It enables the Enthalpy Control with summer/winter changeover set point through (D.i.2) contact.

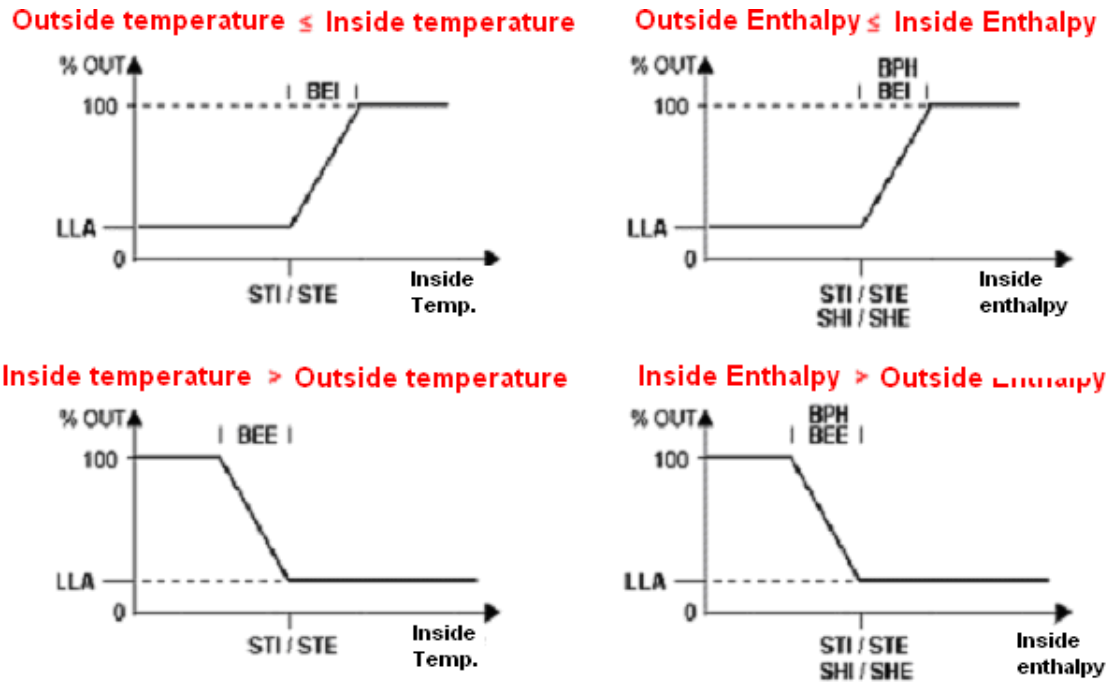
By D.i.2 open contact, the loop goes in Enthalpy control with winter set-point, by closed contact, loop goes in Enthalpy control with summer set-point.

The two sets (STI) winter and (STE) summer are independent.

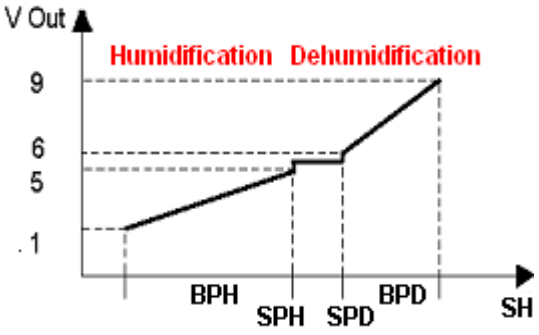
The (BEI) internal and (BEE) external proportional bands are always the same both in winter and in summer, as well as the (LLA) minimum opening limit value.

By outdoor Humidity signal it is necessary to set also SHI and SHE winter and summer humidity set points and (bPH) humidity band.

The comparison between internal and external enthalpy must last for at least a time exceeding 15 min. to avoid output hunting when the enthalpy values are almost the same.




MODE A4: HUMIDIFICATION/DEHUMIDIFICATION SEQUENCE LOOP




To be selected when it is required to exploit the 0-5, 6-10 control characteristics of Controlli actuators to perform a humidification/dehumidification sequence with a unique 0-10 Vdc output, driving in sequence proportional humidifier and cooling valve.

When the set point value is achieved, the output is 5.5 Vdc

When the control humidity drops under the (SPH) humidity set point minus (BPH) Humidity Proportional Band, the relevant analogue output is 0 Vdc.

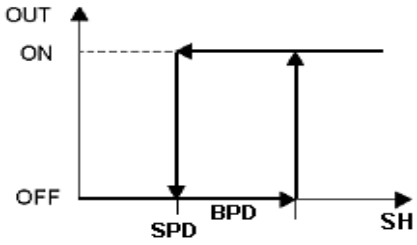
When the control humidity exceeds the (SPD) Dehumidification Set Point value plus (BPD) Dehumidification Proportional Band, the relevant analogue output is 10 Vdc.

The two actuators must be connected in parallel to the same output setting the range 0-5Vdc with reverse action for the actuator which drives the proportional humidifying channel, whilst for the actuator which drives the cooling channel it is necessary to select the range 6-10Vdc with direct action.

## FOR THE DIGITAL RELAY OUTPUT 2 IT IS POSSIBLE TO SELECT:

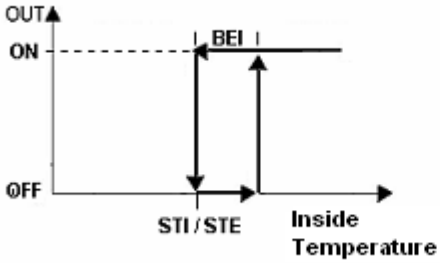
MODE D1: ON/OFF HUMIDIFICATION HYSTERESIS
If the output value must turn to ON when the value of **H** Humidity Sensor drops under (SPH) operating humidity set value minus (BPH) hysteresis band.
When the set point is achieved the relay output is OFF.

MODE D2: ON/OFF DEHUMIDIFICATION HYSTERESIS
If the output value must turn to ON when the value of **H** Humidity Sensor exceeds the SPD operating dehumidification set point plus (BPD) hysteresis band.
When the set point is achieved the relay output is in OFF status.

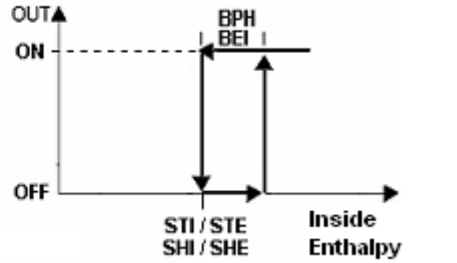



MODE D3: ENTHALPY HYSTERESIS WITH S/W CHANGEOVER SET
If the enthalpy control with S/W changeover set through (D.i.2) contact input is required.
By D.i.2 open contact, the loop goes to enthalpy control with winter set-point; by closed contact the loop goes to enthalpy control with summer set-point.
The two sets STI winter and STE summer are independent.
The (BEI) internal and (BEE) external proportional bands are always the same both in winter and in summer.
By outdoor humidity signal it is necessary to set also SHI and SHE winter and summer humidity set points and (bPH) humidity band.
The comparison between internal and external enthalpy must last for at least 15 min. to avoid output hunting when enthalpy values are almost the same.

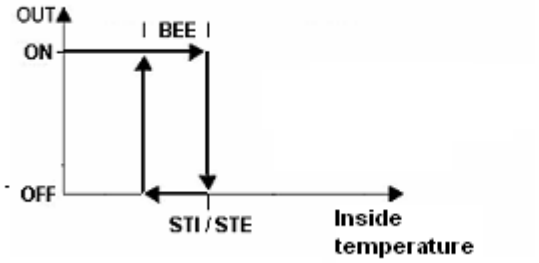
**Outside temperature ≤ Inside temperature**



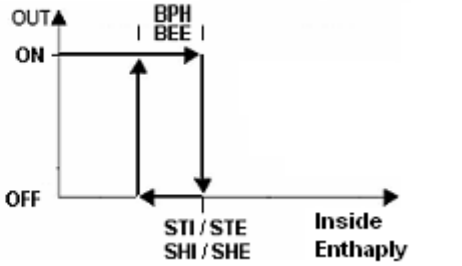

**Outside Enthalpy ≤ Inside Enthalpy**




**Inside temperature < Outside temperature**




**Inside Enthalpy < Outside Enthalpy**




MODE D4: ON/OFF DELAY
If it is required to enable or disable a relay output with a specified stop and/or start delay.
The operation is the same as described for mode D4 of the Relay 1 digital output (see page 6).

## *CONTROL TYPE*

Once the OPERATING MODE is stated, it is necessary to set the CONTROL TYPE, i.e. the control criteria used by the OPERATING MODE. The control type can be:

- Proportional or Proportional + Integral (P or P+I)
- With fixed operation set point or compensated in function of Compensation Sensor.
- With or without minimum and/or maximum limit in function of Limit Sensor.

**PROPORTIONAL CONTROL (P)**

Given a SET POINT (required value), the difference between this value and the VALUE detected by the Control Sensor is called ERROR.
A proportional control is obtained when the value of a controller output moves proportionally to the ERROR. The PROPORTIONAL BAND determines the quantity of the action (gain) in function of ERROR. When the ERROR is equal to the PROPORTIONAL BAND the output value is equal to 100 %.
Setting a too small PROPORTIONAL BAND can generate oscillation phenomena of the output. Setting an excessively wide PROPORTIONAL BAND can generate a change from the SET of the controlled temperature.

**PROPORTIONAL CONTROL + INTEGRAL (P+I)**

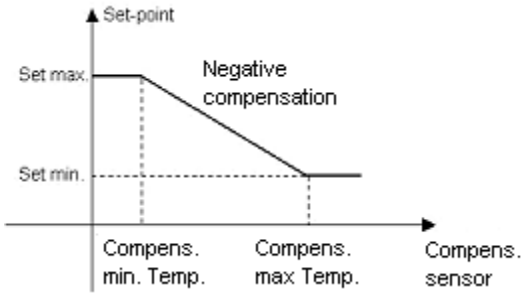
If an **I** action is added to **P** action, the result is a more accurate control, which takes into account the error variation in time. It is necessary to define an INTEGRATION TIME, which states the time, after which the Proportional action is restored. Generally, INTEGRAL action is necessary when the PROPORTIONAL BAND allows a variation, conferring to the INTEGRAL action the task to cancel the remaining error.
The two 0-10 Vdc analogue outputs can be P or P+I, therefore, the parameters to be set for each output will be:
- SET POINT (with fixed-point control)
- PROPORTIONAL BAND
- INTEGRATION TIME (if I action is enabled)

For analogue output 2 in A3 operation mode (enthalpy control with s/w changeover set), control can be proportional only, and not P+I.
The 2 relay outputs can be only P, the parameters to be set will be:
- SET POINT (with fixed-point control)
- HYSTERESIS BAND

For the analogue output 1 and the relay output 1 it is used the temperature sensor connected to **ST** terminal if not otherwise specified (“sharing sensors” see paragraph concerning LinkBus).
If the temperature sensor is not connected correctly to **ST** terminal or is not shared correctly with other devices Led ⓘ is lighted.
For the analogue output 2 and the relay output 2 it is used the humidity sensor connected to **SH** terminal if not otherwise specified (“sharing sensors” see paragraph concerning LinkBus)
If the humidity sensor is not correctly connected to **SH** terminal or is not shared correctly with other devices, LED ⓘ is lighted.
If necessary it is possible to connect the **SH** terminal to another sensor (air quality, temperature or another 0-10Vdc signal transmitter) the signal value shall anyway be expressed as a percentage with respect to the range end.
In the operating MODE D4 the relay output behaves as a timed sequencer and it controls depending on time events and not on temperature/humidity values.
See page 21 to set the Operating Modes and control types.

## *SET-POINT COMPENSATION*

The operation SET-POINT can be fixed or determined by a compensation slope according to the value given by the compensation sensor.



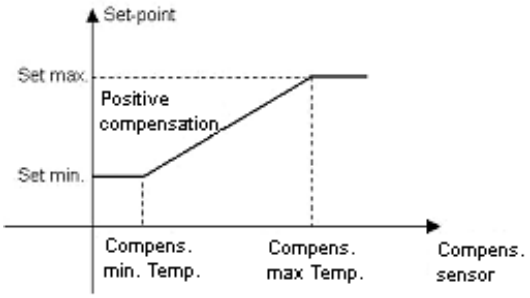

Both A1 and D1 temperature loops can be temperature compensated (the SC sensor is necessary) or humidity compensated (SH sensor). It is necessary to set the **Cth** parameter to state the temperature and humidity compensation. Both A2 and D2 humidity loops can be temperature compensated only (the SC sensor is necessary).

The compensation slope is a broken line touching two points and given by four values.

Depending on the value given by the sensor, a set-point value shall be defined in a range between a minimum and a maximum.

"Negative Compensation" means when the operating set-point increases while the compensation sensor value decreases.

"Positive Compensation" means when operating set-point increases by the increasing of compensation sensor value.




It is possible to set Negative and Positive Compensations both for temperature and humidity control loops.

Each operation set-point value, both by temperature (heating and/or cooling) and by humidity (humidification/dehumidification) control loop can be associated to a relevant slope resulting by two values:

- SET-POINT 1 corresponding to TEMPERATURE 1
- SET-POINT 2 corresponding to TEMPERATURE 2

If the Compensation Sensor is present and the Compensation of an Operating Mode is enabled, it is necessary to determine the four values of the curve. Such values become eight in case of Operating Mode A3, A4 and D3 because it is necessary to set compensation both for the heating and for the cooling loops. In the latter case, if compensation should be disabled for one of the two Loops only, it is necessary to set the minimum Set-point equal to the maximum value achieving a fixed operation Set-point. It is not possible to enable compensation in Operating Mode D4.

While the A2 and D2 loops can be compensated through the SC temperature sensor, loops A1 and D1 may be temperature or humidity compensated. The selection is made under the Level II menu (label Cth).

For the temperature compensation the Compensation Sensor used is the one connected to **SC** input, if not differently specified ("SC sharing" see paragraph related to LinkBus). To enable Compensation first connect or share the Compensation Sensor. If compensation is enabled on any Operating Mode and the Compensation Sensor is not connected correctly to **SC** terminal or is not shared correctly with other devices, the Anomaly led ⓘ lights up and the control Set-point becomes the value set for fixed point, i.e. without Compensation.

For humidity compensation the possible absence of SH sensor does not generate any fault since its value can be 0.

By humidity control loops, the possibility to compensate the set point depending on **SC** signal is used either to perform the remote setting of humidity set point through a potentiometer (see remote set page 14) or e.g. to compensate linearly minus the room humidity set according to the inner temperature of glass surface (anti-frost function in swimming pools or wet environments).

In this case, the temperature sensor connected to **SC** must be located in the indoor part of the glass wall.

For all compensation parameters settings see page 18

## *MIN/MAX HUMIDITY LIMITS ON A1 AND D1 LOOPS*

Limit loops are optionally active in A1 and D1 loops only; they are P-type and always operate with fixed set-point. If enabled, they work in parallel to the control loop. For each operating mode (except Mode D4) both minimum and maximum limits can be enabled separately.

For each control loop different settings are available:

- Limits disabled
- Active minimum limit for heating
- Active maximum limit for cooling

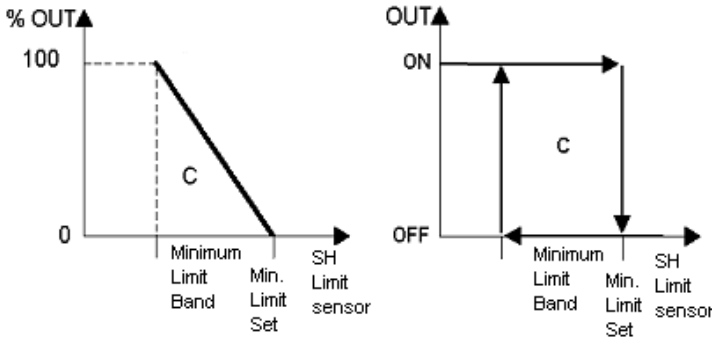
The behaviour of a limit loop output will be different if the loop is in heating or cooling mode.

For A3, A4 and D3 operating modes, it is possible to enable the minimum limit for heating and/or the maximum limit for cooling.

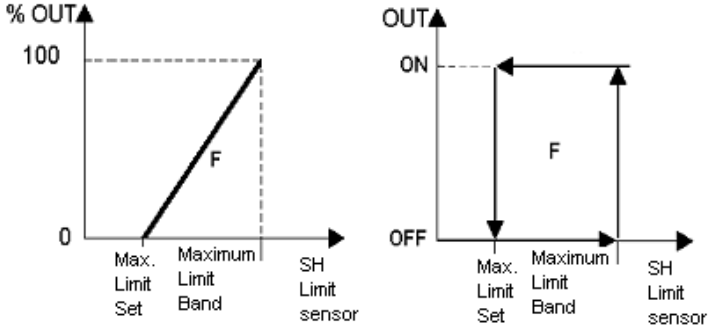
The term “minimum humidity limit” indicates a function intended to avoid that the humidity detected by the **SH** limit sensor drops under given values.

The term “maximum humidity limit” indicates a function intended to avoid that the humidity detected by the **SH** limit sensor exceeds given values.

*Minimum Humidity Limit in Heating Loop*




*Maximum Humidity Limit in Cooling Loop*




In a **HEATING LOOP:**

If the **Minimum Humidity limit** function is enabled, it uses the output **maximum value** among the limit Loop and Control Loop. A greater heat supply allows a better operation of the humidification device, avoiding the risk of condensation and improving the plant efficiency. If the Minimum limit is enabled, it is necessary to define:

- MINIMUM LIMIT SET POINT
- MINIMUM LIMIT PROPORTIONAL BAND

In a **COOLING LOOP:**

If the **Maximum Humidity limit** function is enabled, it uses the output **maximum value** among the limit Loop and Control Loop. A higher cooling in the air duct allows reducing the humidity supplied to the environment. If the Maximum limit is enabled it is necessary to define:

- MAXIMUM LIMIT SET POINT
- MAXIMUM LIMIT PROPORTIONAL BAND

It is not possible to enable the Limit function in operating mode D4. The Limit Loop set point operates at fixed point and is not modified neither in *Reduced* mode. The Limit Loops are disabled under *Stop* Operating Mode. The Limit sensor used by the loops A1 and D1 is the one connected to the **SH** Humidity sensor input, if not differently specified (“SH sharing” see paragraph related to LinkBus). If the Limit is enabled on any Operating Mode and the Limit Sensor is not connected correctly to **SH** terminal or is not shared correctly with other devices, the Anomaly Led ⓘ switches on, the control loops A1 and/or D1 are stopped and the relevant Ao1/Rel1 output switched off.

For all limit parameters settings see page 18.

## *OPERATING MODES*

The equipment is able to operate according to three different operating modes, which are:

**0) Comfort** – all loops are ON during control (including the Limit Loops).
**1) Reduced** – the Control Loops operate on a reduced Set point. The Limit Loops remain ON with their set point.
**2) Stop** – all loops are 0 (including the Limit Loops).

The Operating Mode acts in parallel on all Control Loops also in Mode D4 (sequence controller), in which Comfort and Reduced modes have the same meaning.

The passage from an Operating Mode to another can take place as follows:

- Using the appropriate Manual override key **Ovr** ☝. If it is pressed repeatedly, it is possible to access manually to one of the three modes. This function is active in each Control Loop, by setting ABO = On. For further details see page 11.

- From *Time schedule:* it changes automatically into one of the three modes. This function is enabled on each Control Loop, by setting ABO = On.

- Through digital input D.i.1 and/or D.i.2 (except modes A3 and D3); if enabled (AE1 = On and/or AE2 = On), it is possible to pass from Stop (open contact) to another mode, i.e.:

Changeover from digital inputs with dry contact operates on all Loops whose function is enabled (AE1 or AE2 with value On). Such operation has a priority with respect to other changeovers (from clock or Manual override button). The enabled Operating Mode is signalled by a proper Led **Mode** on the front panel, as follows:

| Led Mode Status | Operating Mode enabled |
|---|---|
| ON | Comfort |
| Blinking | Reduced |
| Off | Stop |

Through the LinkBus it is possible to share the override mode, although a local override on the single device has always priority with respect to the shared mode.
The Stop mode in Mode A4 produces a 5,5 Vdc output.
The default operating mode is determined by the *Time Schedule* if the clock is present, otherwise the default mode is Comfort. The manual override key is disabled if the device is switched of and on again. For further detail see the three following paragraphs.

## *MANUAL OVERRIDE KEY FOR THE OPERATING MODE*

It is possible to carry out a manual override of the Operating Mode by pushing the proper key **Ovr**☝ inside the *Operating Mode Programme Menu* accessed by holding the **Set** key down for 5 seconds. The manual override cancels the mode determined by the clock and it is signalled by the Led **Ovr** on the front panel. The number of clicks on such key, states cyclically the setting, passing from Comfort, to Reduced and Stop modes, then returning to Automatic mode.

## *CLOCK ENABLE WITH TIME SCHEDULE*

If the W500 is RTC-provided or it is connected via LinkBus to a device with clock, it is possible to define the Operating Mode according to a weekly schedule and a daily schedule. The clock enable of each Control Loop is obtained by setting the parameter ABO = On. If the device with clock is connected via LinkBus to other equipments without clock, the mode can be shared and all the equipments will follow simultaneously the same time schedule.

*Weekly schedul*e:
For each day of the week it is possible to define either a fixed mode (On = Comfort, rid = Reduced, OFF = Stop) or a complete daily schedule (expressed by the Pr1 value), or only the first two (Pr2 value), or only the last two (Pr3 value) changeovers of the daily schedule.

*Daily schedul*e:
It is possible to carry out up to 4 time changeovers defining, for each one, hour, minute and mode.
Unused changeovers must be filled in with the same values of the last valid changeover.
For the setting of both weekly and daily time schedules, see page 25.

## *OUTSIDE DIGITAL ENABLE*

Two digital inputs are available: they can be used independently by the 4 Control Loops to override the active operating mode. It is necessary to make a distinction between HMB model (with clock) and H model (without clock).
In both models, if parameter Abo = OFF (enabling by clock disabled) the Loop is STOPPED; if parameter Abo = ON it follows the time schedules in HMB model and it is always in Comfort mode in H model.
At this point, if on a Control Loop the Outside enable is started with parameter AE1= ON and/or parameter AE2 = ON:
In HMB model
the D.I. 1 and/or D.I.2 contacts enable the Loop outside the time schedules
In H model
nothing happens (the loop is always in COMFORT mode)
If parameter Abo = OFF and parameters AE1= ON and/or parameters AE2= ON, the D.I. 1 and/or D.I. 2 contacts are open the Loop is STOPPED, if one or both of them are closed the Loop is in COMFORT mode.
If the Loop is configured to operate in A3 or D3 mode (Heating/Cooling by S/W changeover) the digital input 2 is only used for this purpose.
The enabling from contact (Loop starting override) has priority with respect to the other changeovers (from clock or manual override with **Ovr** key).

| **Operating mode enabled** | **Contact D.i.1 AE1 = On** | | **Contact D.i.2 (*) AE2 = On** | |
|---|---|---|---|---|
| | **Open** | **Closed** | **Open** | **Closed** |
| COMFORT | STOP | COMFORT | STOP | COMFORT |
| REDUCED | STOP | REDUCED | STOP | REDUCED |
| STOP | STOP | COMFORT | STOP | COMFORT |

(*) Function not active in A3 and D3 modes

## *FACTORY DATA LOAD*

Through this function it is possible, if required, to reset all the factory settings and parameters.
This function is useful for example when the user has set different values and requires restoring the initial conditions in a short time.

## *STORING DATA IN PERMANENT MEMORY*

Once the parameters for a plant are set, it is possible to store such customization in order to restore them when required.

## *LOADING DATA FROM PERMANENT MEMORY*

This function allows restoring all the configurations and parameters, which were previously saved by the, MEMORY DATA STORAGE function.

## *REMOTE SET*

When a control with Fixed-point set is required, the Compensation Sensor is not used.
In this case, it is possible to connect a suitable potentiometer (instead of the **Compensation Sensor** local input) to carry out a remote setting of the Operation Set-point.

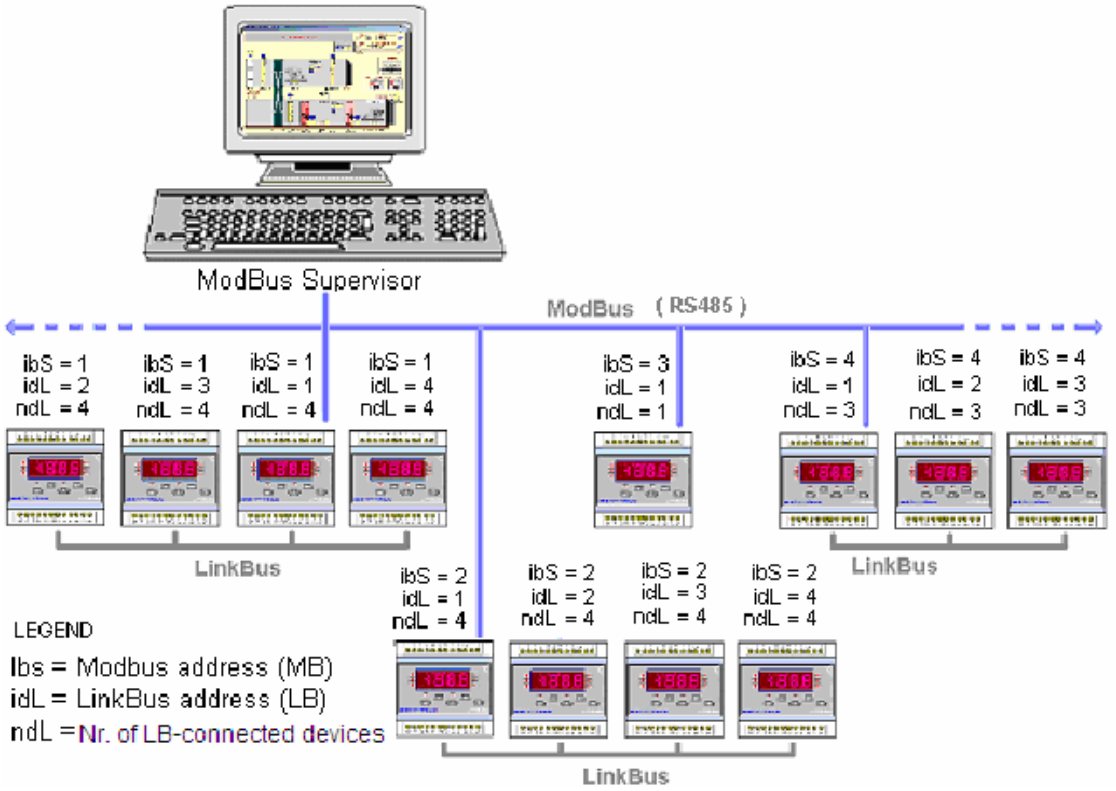
PARAMETER SETTING
Enable Compensation and define the four points of the line:
Keep into consideration that TEMPERATURE 1 corresponds to the value read at one potentiometer end and TEMPERATURE 2 to the value read at the other end.

- SET 1 corresponding to TEMP 1
- SET 2 corresponding to TEMP 2

The value displayed by the Compensation Sensor is purely indicative and does not correspond to the actual temperature in °C.

## *LINKBUS COMMUNICATION*

The LinkBus serial communication port allows to 2, 3 or 4 equipments to interoperate for data exchange. The LinkBus connection allows sharing the three sensors and Operating Mode and supervising the devices, which do not have the RS485 serial communication port.
The equipment connected via LinkBus must have a univocal address (IDL) that can be set by the menus from 1 to 4. The equipment with idL = 1 (Master) communicates its Operating Mode to the other controllers connected via LinkBus. If the Master is RTC-provided (RTC is not necessary for the others), the 4 controllers can operate according to the same time schedule. The equipment without the RS485 serial communication port (W500T or W500H) can be supervised if connected via LinkBus to at least one equipment with RS485 (W500TMB or W500HMB), setting it as Master (i.e. idL = 1).
Each IDL address corresponds to a LinkBus “channel” on which the controller communicates the values of its own temperature sensors connected to the terminals. Each device communicates its values on the LinkBus channel determined by the assigned IDL address number. If it is required a sensor connected to the terminals of another controller, it is necessary to operate on parameters menu of Sensor Selection (SEL) and to select the channel for reading. For example, a controller with idL address = 2, which uses the Compensation Sensor connected to **SC** terminals of the equipment having idL address = 3, the value SSc in the sensor selection parameter menu (SEL) must be = 3. If the sensor to be used is connected to the controller terminals, the setting will be SSc = 2. For each one of three sensors it is necessary to specify its location, if the sensor is local, it is necessary to state the proper IDL address.
It is necessary to set the (NDL) Link number to transmit their values through the LinkBus channel; NDL is the number of the equipment connected through the same LinkBus (max 4). The equipment connected to LinkBus, which must <u>not</u> transmit their data, can be set with ndL = 1, this configuration is allowed (to speed up the transmission of data on LinkBus), but it is not advisable when supervision data via ModBus is requested. The equipment connected to LinkBus which do not transmit their data can anyway receive data from other equipment connected via LinkBus.




It is important that all equipment connected to LinkBus, which must transmit their data, have the same NDL value. For example, if only three equipment on four must transmit data, three shall have ndL = 3 and one ndL = 1. The equipment which must not transmit data, but only receive, must have idl address higher than the equipment which transmits.

For example: if only three equipments on four must transmit data, three shall have idL = 1, 2, 3 and one idL = 4. A low ndl value increases data update which occurs in a minimum time of 40 sec. with 10 sec. for each transmitting controller. The advisable max distance between to extreme equipment of LinkBus is 10 m. Such distance should allow any connection inside an electrical switchboard. It is strongly recommended the use of shielded cables with earth screen at one end only, if power equipment (contactors, inverters, UPS, reactors, etc.) is present. It is essential to keep adequate distance (30 cm. at least), between cable and wires, otherwise use metal tracks. It is recommended the use of 24 AWG or 26 AWG twisted pair and do not carry out star connections. The default values of the Bus menu are idL = 1 and ndL = 1. For LinkBus address setting and sensor selection see page 20.

## *ENTHALPY COMPARISON WITH OUTDOOR HUMIDITY SENSOR FROM ANOTHER W500H*

When the function Enthalpy Comparison is active (mode A3 for analogue output 2 and/or D3 for relay output 2) it is possible to utilize **SH** signal from another W500H as outdoor humidity sensor.
In this case we achieve a complete Enthalpy comparison of temperature and humidity using the outdoor humidity value sent through the LinkBus by another W500H. Practically, each W500H copies its SH signal value on the **SSE** channel (outdoor sensor signal) to share it with other W500H. E.g. if a controller with address idL = 1 requires to use as outdoor humidity sensor the one connected to another controller with address idL = 2, it must set the reading value of the external channel as SSE = 2

To perform the complete enthalpy comparison it is necessary the presence of both humidity sensors (indoor and outdoor) with an SSE value different from SSH. When the enthalpy is complete, it enables all Set Point and the Bands are processed by the following formula:

Enthalpy= H x $10^{(0,0275xT-1)}$ +T

Attention: parameter USE = ON disables outdoor humidity processing (see page 17).

## *MODBUS COMMUNICATION*

Through the ModBus protocol it is possible to supervise up to 255 groups of 4 equipments, for a total of 1020 devices. The ModBus connection is carried out on the equipment with **IDL** = 1 (Master) through the RS485 serial port. The values managed by supervision and those managed by the controller menu are the same. The Bus Supervision address IBS (ModBus address) of the single device must be set manually on the configuration menu. The default ModBus address is ibS = 1. The devices connected via LinkBus must have the same ModBus address of the Master. For ModBus data address see the relevant Database documents supplied on demand.

The wiring path between the two most distant devices connected to RS485 serial must not exceed 1000 m.: we recommend to use a 24AWG or 26AWG twisted-pair cable and not to carry out star connections.
**The first and the last device must be terminated by a 120-Ohm ¼-Watt resistance.**
If devices from different manufacturers are present on the same communication Bus, it is necessary to respect the limits imposed and to be careful not to use the same ModBus addresses of other devices. We recommend using a shielded cable for RS485 Bus if on the plant or inside the switchboard are present power devices, always keeping the suitable distances and precautions regarding signal wiring and power cables.
For ModBus address set up and outside compensation from supervision, see page 21.

## *USE OF SUPERVISION OUTSIDE SENSOR FOR COMPENSATION*

If outdoor sensor on (USE=ON) is enabled, it is possible to perform compensation through a value sent by communication bus (supervision). Practically it is a virtual sensor which can be used instead of a physical sensor connected to SC terminals.
If, for example, on the whole plant there is only one sensor outside the building, this function allows using its value on all controllers connected to the supervision. Likewise from supervision it is possible to set a unique set point to the various devices connected.
Attention: parameter USE = ON disables SH humidity sensor on SSE channel (see page 15).
For outside compensation setup from supervision, see page 21.

## *ERROR SIGNALLING*

The controller is able to signal two anomaly conditions, one depending from communication and the other from Sensors. If a Communication ERROR is present, the Anomaly Led ⓘ blinks. It is possible to have a communication fault when, for example, two equipments connected via LinkBus use the same IDL address or in case of high noise on communication, which provokes faulty data transmission. Inside switchboards, in presence of power devices (contactors, Inverters, UPS, reactors, etc.), **we recommend to use shielded cables** (both for sensors and Bus) to reduce anomaly probability.
If a sensor anomaly occurs, the Anomaly Led ⓘ lights up. If both anomaly conditions occur, the Led blinks. Once the Communication anomaly is cancelled, the Led remains on indicating the Sensor ERROR.
For a correct operation the anomaly Led must be switched off.

The conditions, which most frequently produce anomalies, are:
- Sensor is no more present with enabled function
- Sensor outside the controller (shared with LinkBus) is not present
- Multiple devices have the same IDL address

# FRONT PANEL AND DATA ACCESS MENU


Using Front Panel, it is possible to access the Parameters managed by the device. The data access Menu is subdivided into three different levels:
**Level 0** – Main data display
**Level 1** – Access to parameter configuration menu
**Level 2** – Access to the Operating modes programme menu

**Level 0** is the one displayed by default. If no keys are pushed for some seconds this level is automatically re-entered from the higher levels.
At this Menu level it is possible to visualize on the FND display the temperature values of the connected sensors (also via LinkBus) and the values of analogue outputs Ao1 and Ao2 expressed as a percentage. Data display is achieved by pushing the buttons **Up** or **Down**; while Led signalling the displayed analogue input or output lights up. If an input is not present, it is not displayed. The digital input led **D.i.1** and **D.i.2** are on with closed contact, the **Rel1** and **Rel2** relay output leds are on if they are energized. Such leds are always visible at any menu level. The **Mode, Ovr** and anomaly LEDs have already been described in the respective chapters.
To access **Level 1,** push the Set key. At this level it is possible to change the control Parameters of the two analogue outputs [PA1] and [PA2], of the two Relay Digital outputs [Pd1] and [Pd2] and, for W500HMB controllers only, also the clock [rtc]. It is always necessary to set the clock at the first start-up or if the equipment has been powered off for over 30 hours. In order to set date and time, scroll the menu at the level 1 until the corresponding label [rtc] is reached. The label [d00] (days, d00 = Monday) appears by pushing the **Set** key. Push the buttons **Up** or **Down** to set. If the keys are not pushed for some seconds or by pressing **Se**t, the label [h00] (hours) and ['00] (minutes) appears: push the buttons **Up** and **Down** to set respectively hour and minutes. To confirm and save, push **Se**t. If the keypad is not pushed or by pressing the **Esc** key once, the start value appears.

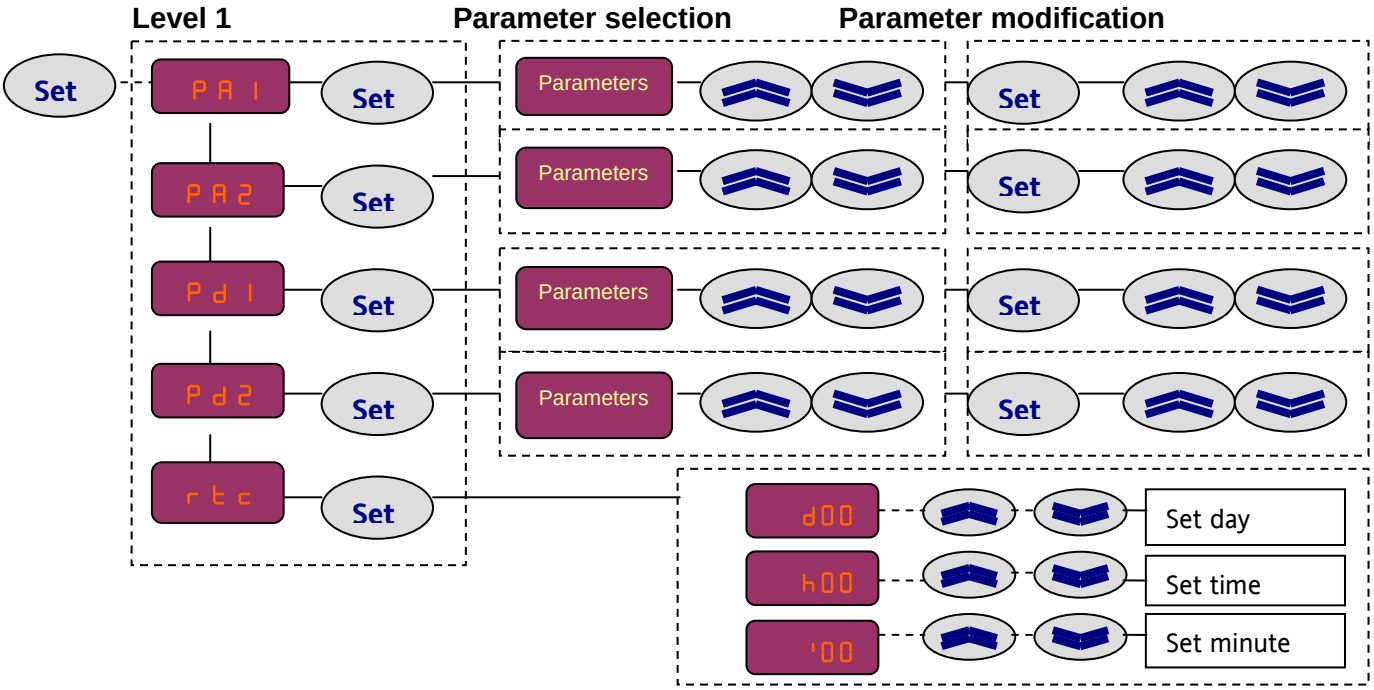
[PA1] label corresponds to the Parameters of Analogue output **1** at **Ao1** terminal
[PA2] label corresponds to the Parameters of Analogue output **2** at **Ao2** terminal
[Pd1] label corresponds to the Parameters of Digital output **1** of **Rel1** relay
[Pd2] label corresponds to the Parameters of Digital output **2** of **Rel2** relay

To modify a parameter, it is necessary to push **Set** after selecting the corresponding Label; the parameter value blinks and can be modified by pushing the keys **Up** to increase or **Down** to decrease. Push **Set** or **Esc** to exit. For the complete control parameter navigation see the *Parameter Configuration Menu* scheme from page 18.

By pushing the **Set** key for at least 10 seconds, **Level 2** appears. At this menu level, it is possible to set:
- the Operating-Set decrease in Reduced mode
- the operating modes of the two analogue outputs [PA1], [PA2] and of the two relay outputs [Pd1] and [Pd2]
- the address parameters for communication [bus], for sensor selection [SEL], for data load [LdE], to save [SdE], restore [dEF] and, for W500HMB devices only, also the time schedules for the automatic changeover of the weekly and daily Operating Mode [Pro].

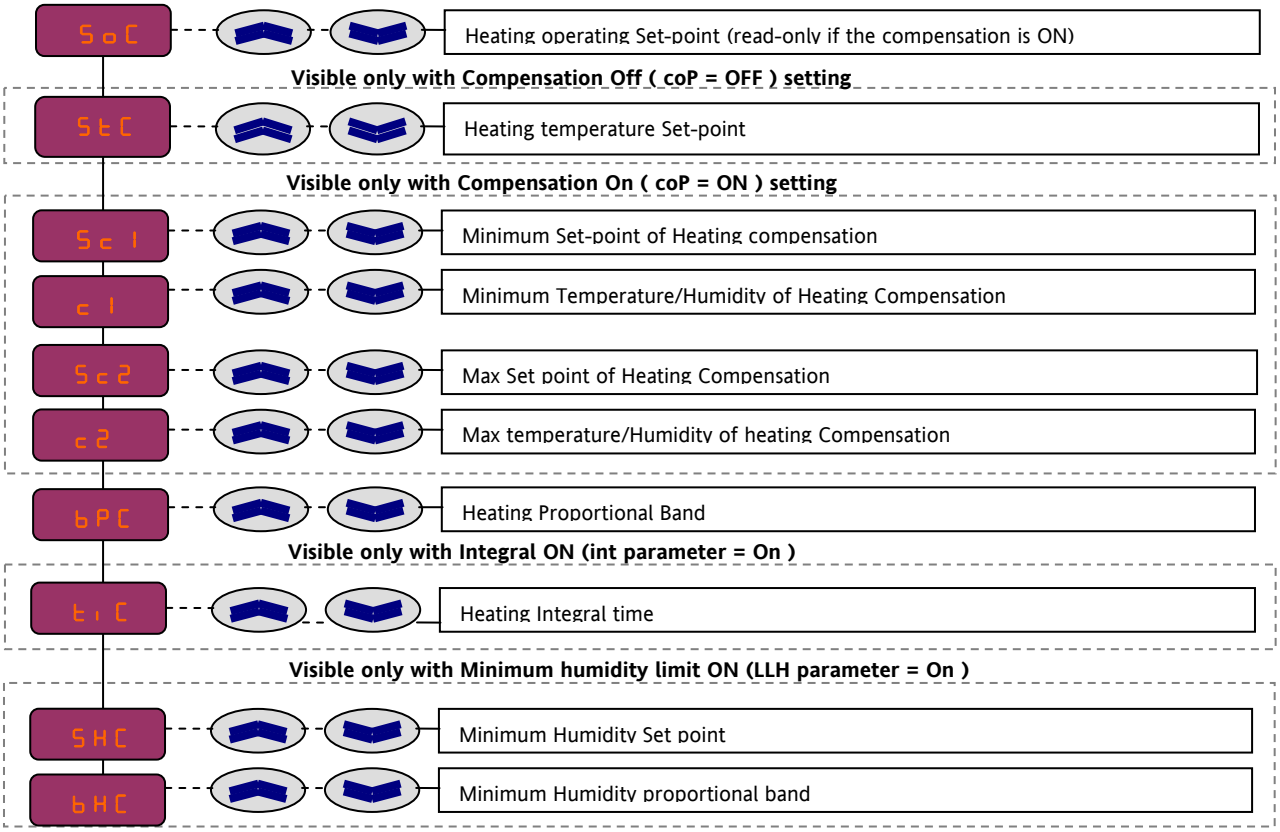
For data navigation see *Programme menu for operating mode and time schedules* on page 21
Note: the time schedules are present only on W500HMB.

## *PARAMETER CONFIGURATION MENU*



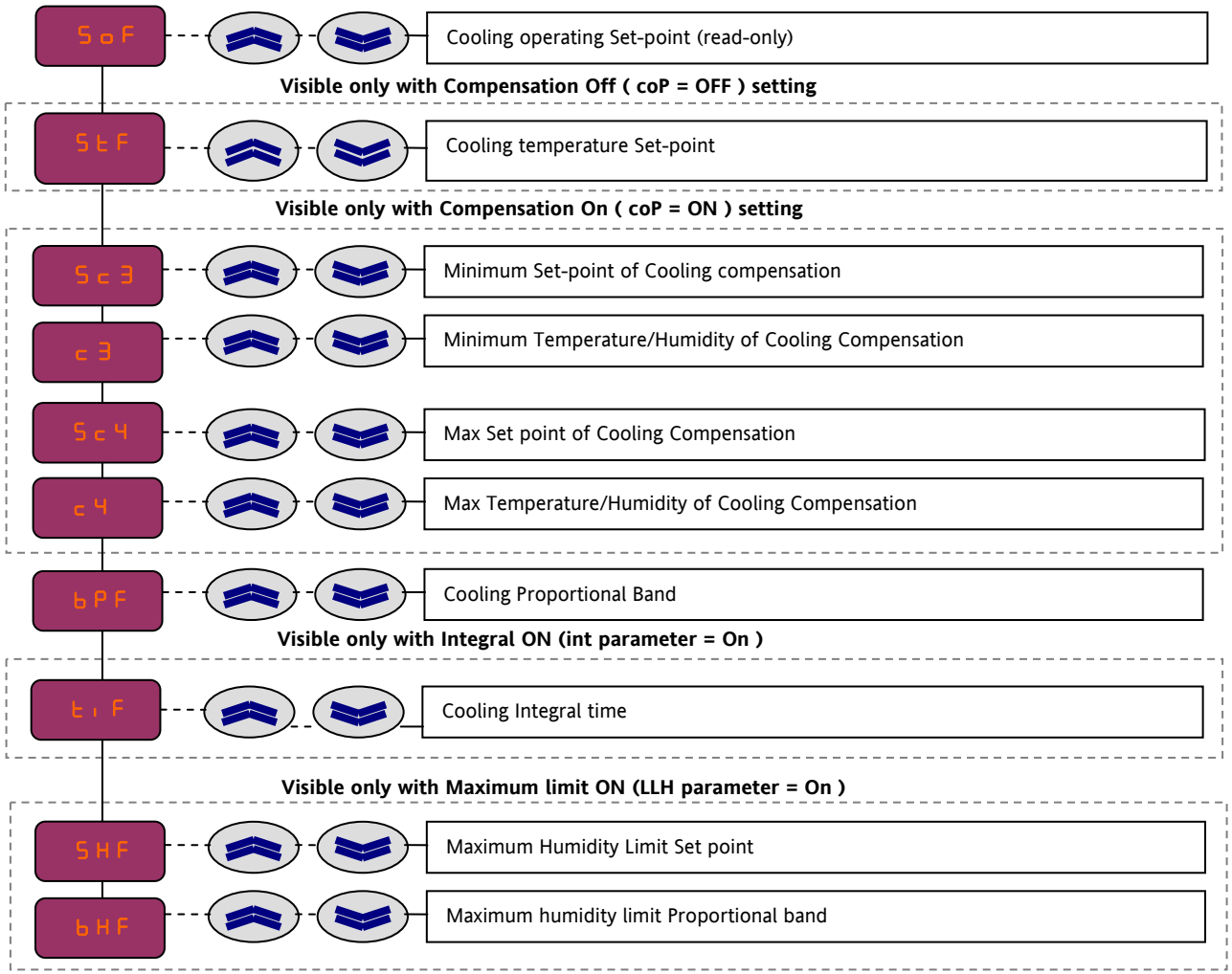

### Parameters Loop PA 1 - Mode A1

Push the **Set** Key and choose the parameter, then push Set again to modify it. The parameter value blinks showing the edit status: push the **Up** and **Down** keys to change values. Once the desired values are modified, push the **Set** or **Esc** keys to exit.



## Parameters Loop PA I - Mode A2

Push **Set** key to select the parameter to be modified. The parameter value blinks showing the edit status: push the **Up** and **Down** keys to change values. Once the desired values are modified, push the **Set** or **Esc** keys to exit.



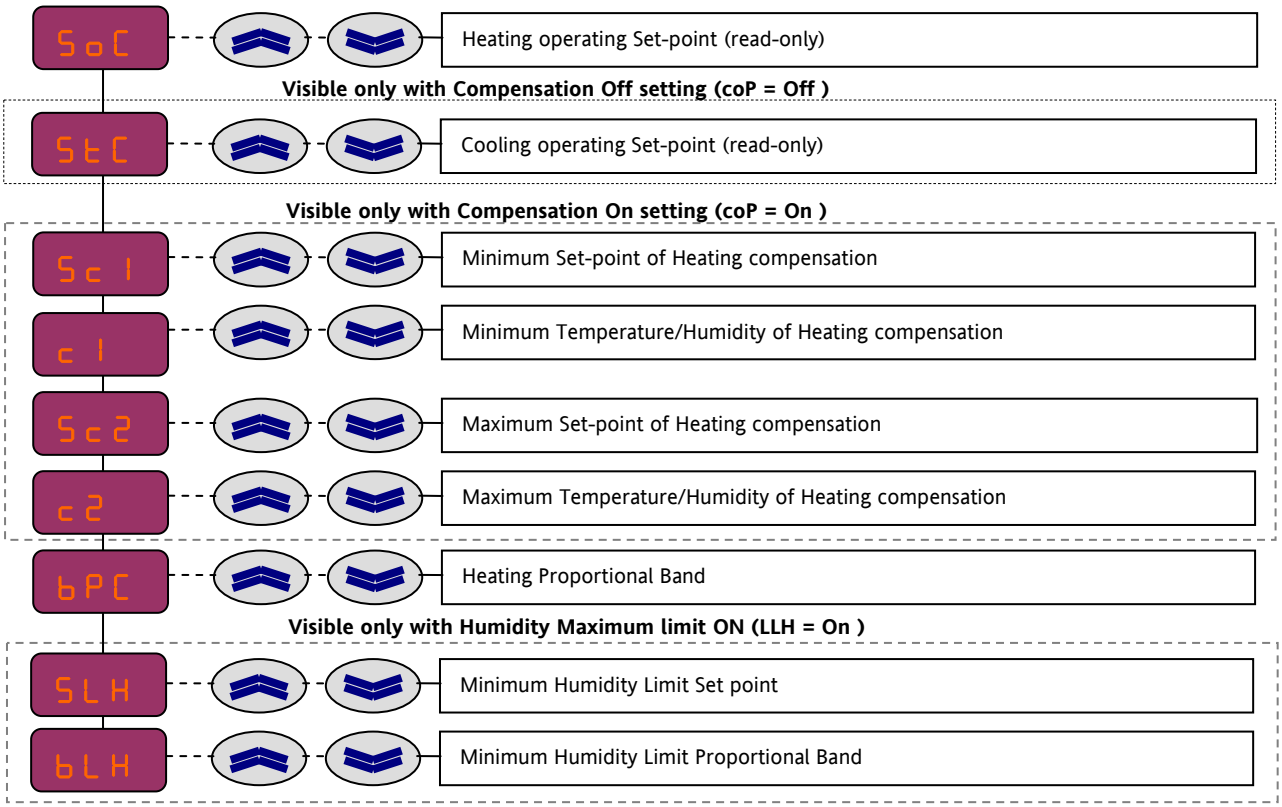

## Parameters Loop PA I - Mode A3 / Mode A4

The parameter menu of the Analogue Operating Modes A3/A4 is the sum of A1/A2 Modes parameter menus. This Menu contains all parameters, since these modes are intended to manage both heating and cooling control loops.

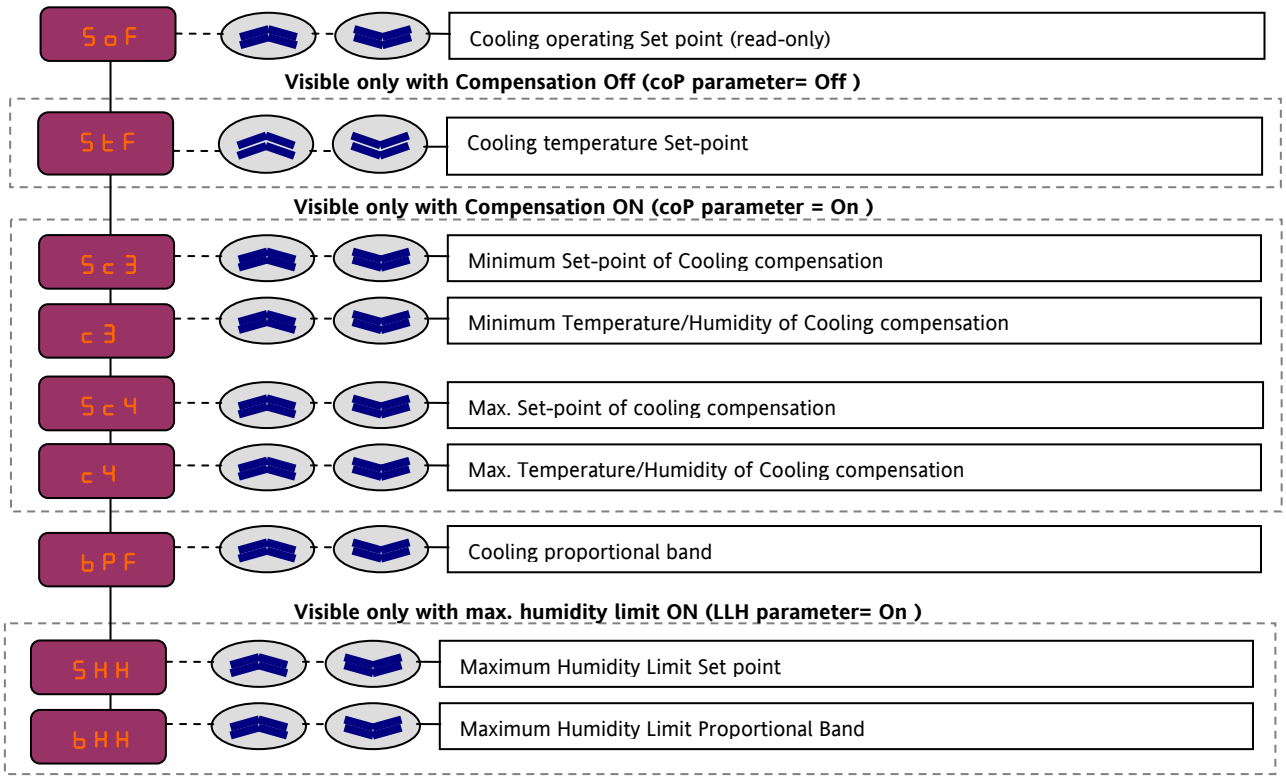
Push **Set** key to select the parameter to be modified. The parameter value blinks showing the edit status: push the **Up** and **Down** keys to change values. Once the desired values are modified, push the **Set** or **Esc** keys to exit. The Compensation/Integral/Limit parameters are visible if the relevant functions in the Operating Mode Programme menu ($2^{nd}$ Level) are enabled. Push **Set** key for 10 seconds to enter the menu.

## Parameters Loop Pd 1 - Mode D1

Push **Set** key to select the parameter to be modified. The parameter value blinks showing the edit status: push the **Up** and **Down** keys to change values. Once the desired values are modified, push the **Set** or **Esc** keys to exit.




## Parameters loop P d 1 - Mode D2

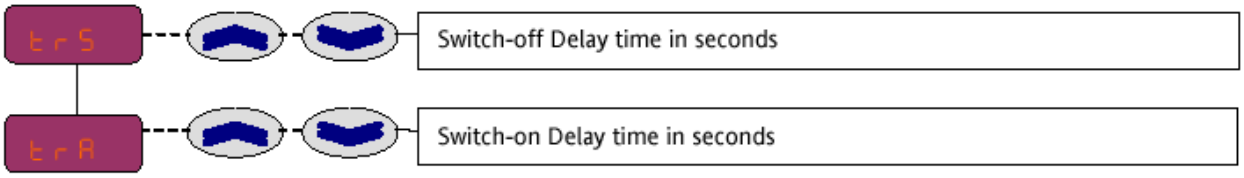


## Parameters Loop P d 1 - Mode D3

The Parameter menu of On/OFF Hysteresis Digital operating Mode D3 is the sum of D1/D2 Modes parameter menus. This Menu contains all parameters, since this mode is intended to manage both heating and cooling control loops.
Push **Set** key to select the parameter to be modified. The parameter value blinks showing the edit status: push the **Up** and **Down** keys to change values. Once the desired values are modified, push the **Set** or **Esc** keys to exit. The Compensation and Limit parameters are visible if the relevant functions in the Operating Mode Programme menu (2nd Level) are enabled. Push **Set** key for 10 seconds to enter such menu.

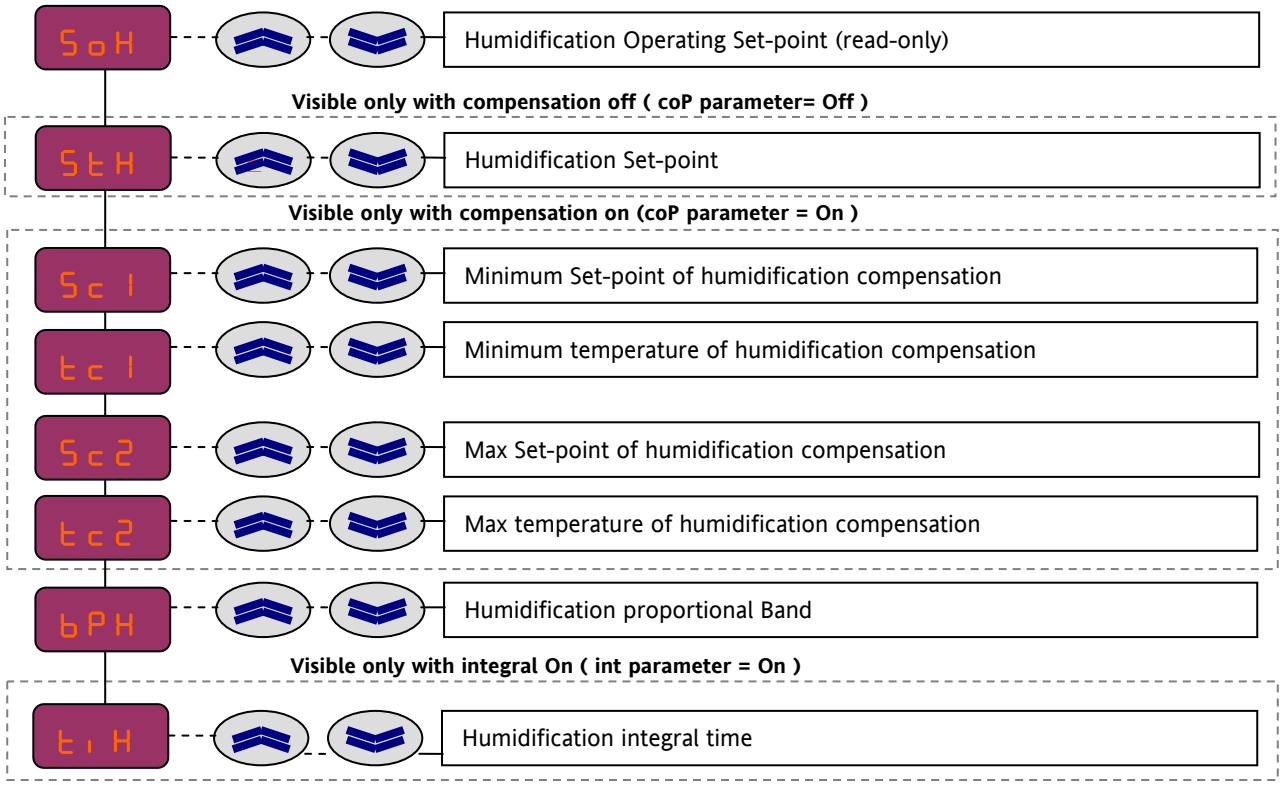
## Sequence Parameters P d 1 and P d 2 - Mode D4

Push **Set** key to select the parameter to be modified. The parameter value blinks showing the edit status: push the **Up** and **Down** keys to change values. Once the desired values are modified, push the **Set** or **Esc** keys to exit.



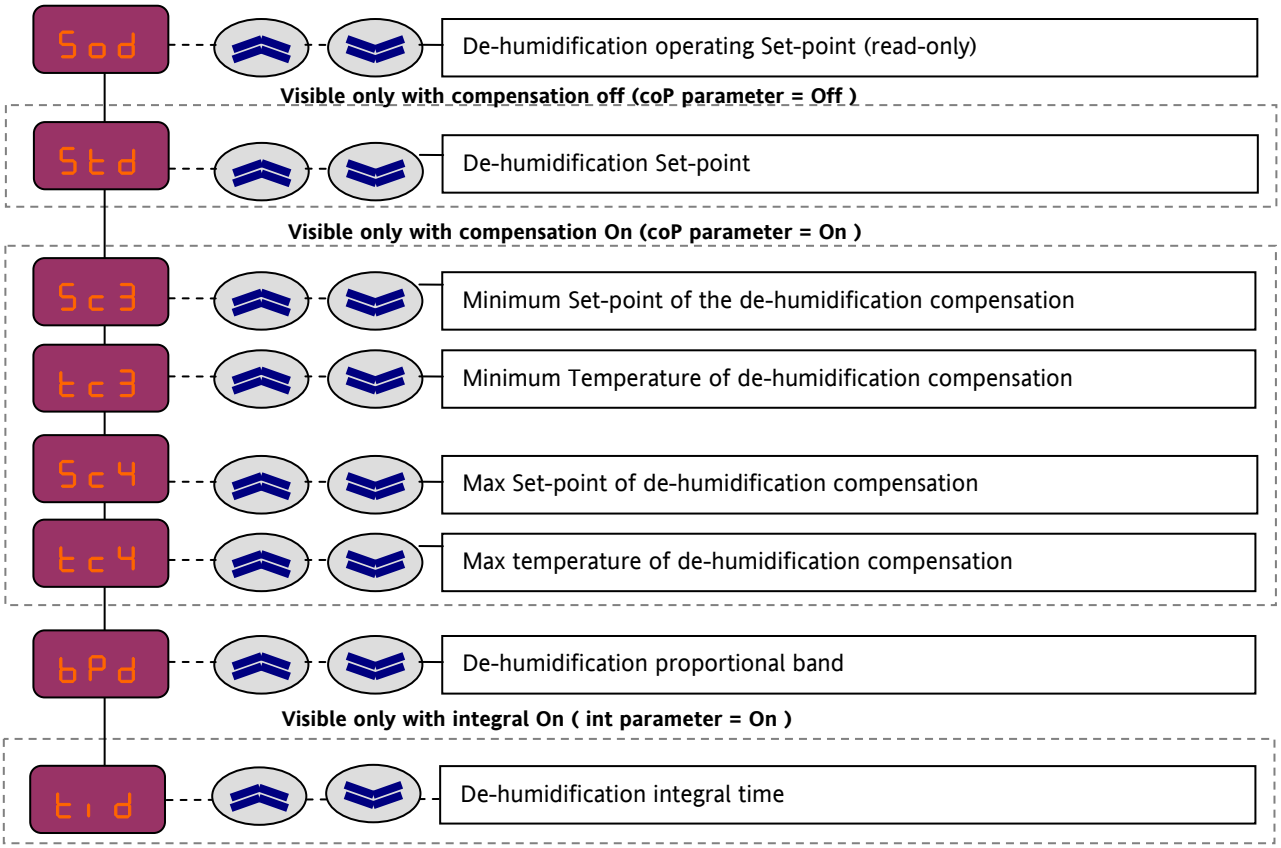

## Parameters Loop P A 2 - Mode A1

Push **Set** key to select the parameter to be modified. The parameter value blinks showing the edit status: push the **Up** and **Down** keys to change values. Once the desired values are modified, push the **Set** or **Esc** keys to exit.



## Parameters Loop PA2 - Mode A2

Push **Set** key to select the parameter to be modified. The parameter value blinks showing the edit status: push the **Up** and **Down** keys to change values. Once the desired values are modified, push the **Set** or **Esc** keys to exit.

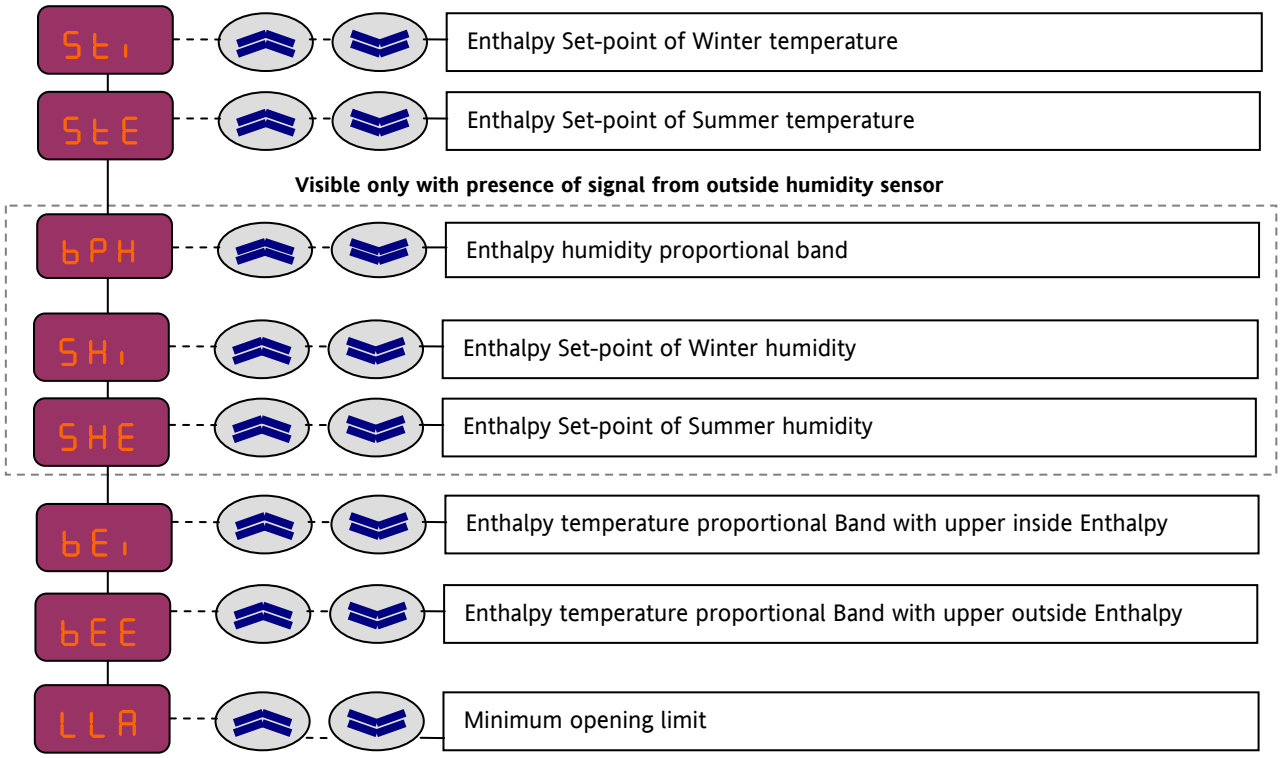



## Parameter Loop PA2 - Mode A4

The parameters menu of A4 analogue operating mode is the sum of A1 and A2 modes parameters menus. This menu contains all parameters since it is intended to manage both humidification and dehumidification control loop. Push **Set** key to select the parameter to be modified. The parameter value blinks showing the edit status: push the **Up** and **Down** keys to change values. Once the desired values are modified, push the **Set** or **Esc** keys to exit.
The compensation, integral and limit parameters are visible if the relevant functions in the operating mode programme menu (2$^{nd}$ level) are enabled.
Push set key for 10 sec. to enter such menu.

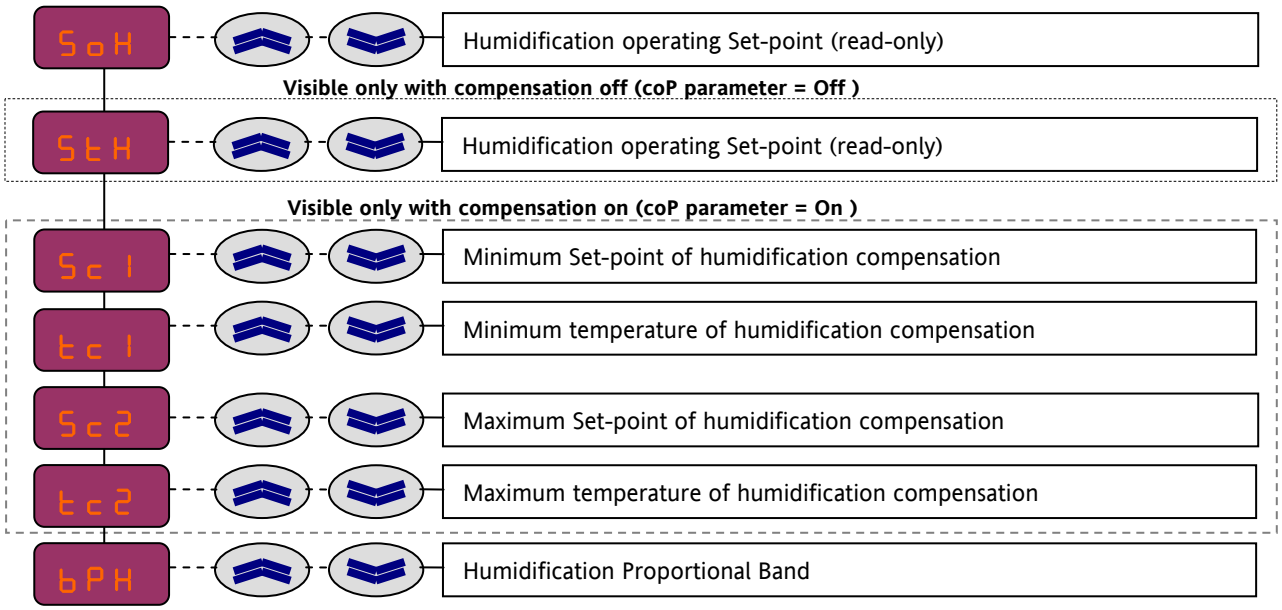
## Parameter Loop PA2 - Mode A3

Push **Set** key to select the parameter to be modified. The parameter value blinks showing the edit status: push the **Up** and **Down** keys to change values. Once the desired values are modified, push the **Set** or **Esc** keys to exit.



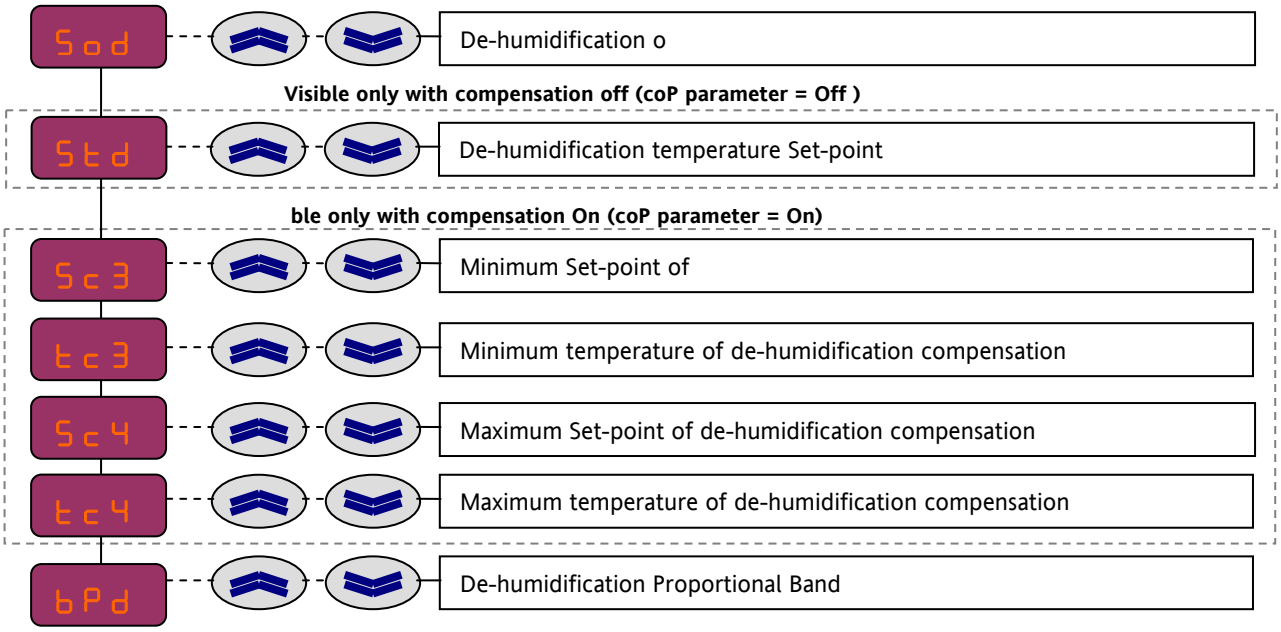

## Parameter Loop Pd2 - Mode A1

Push **Set** key to select the parameter to be modified. The parameter value blinks showing the edit status: push the **Up** and **Down** keys to change values. Once the desired values are modified, push the **Set** or **Esc** keys to exit.



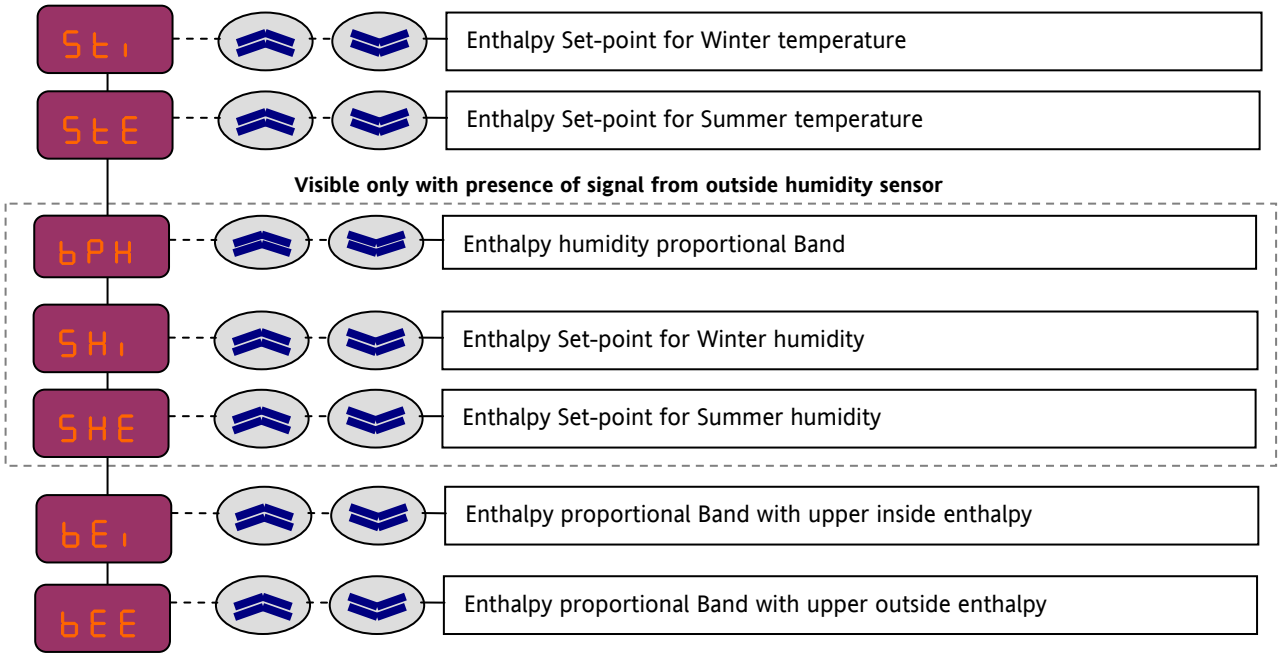
## Parameter Loop Pd2 - Mode A2

Push **Set** key to select the parameter to be modified. The parameter value blinks showing the edit status: push the **Up** and **Down** keys to change values. Once the desired values are modified, push the **Set** or **Esc** keys to exit.

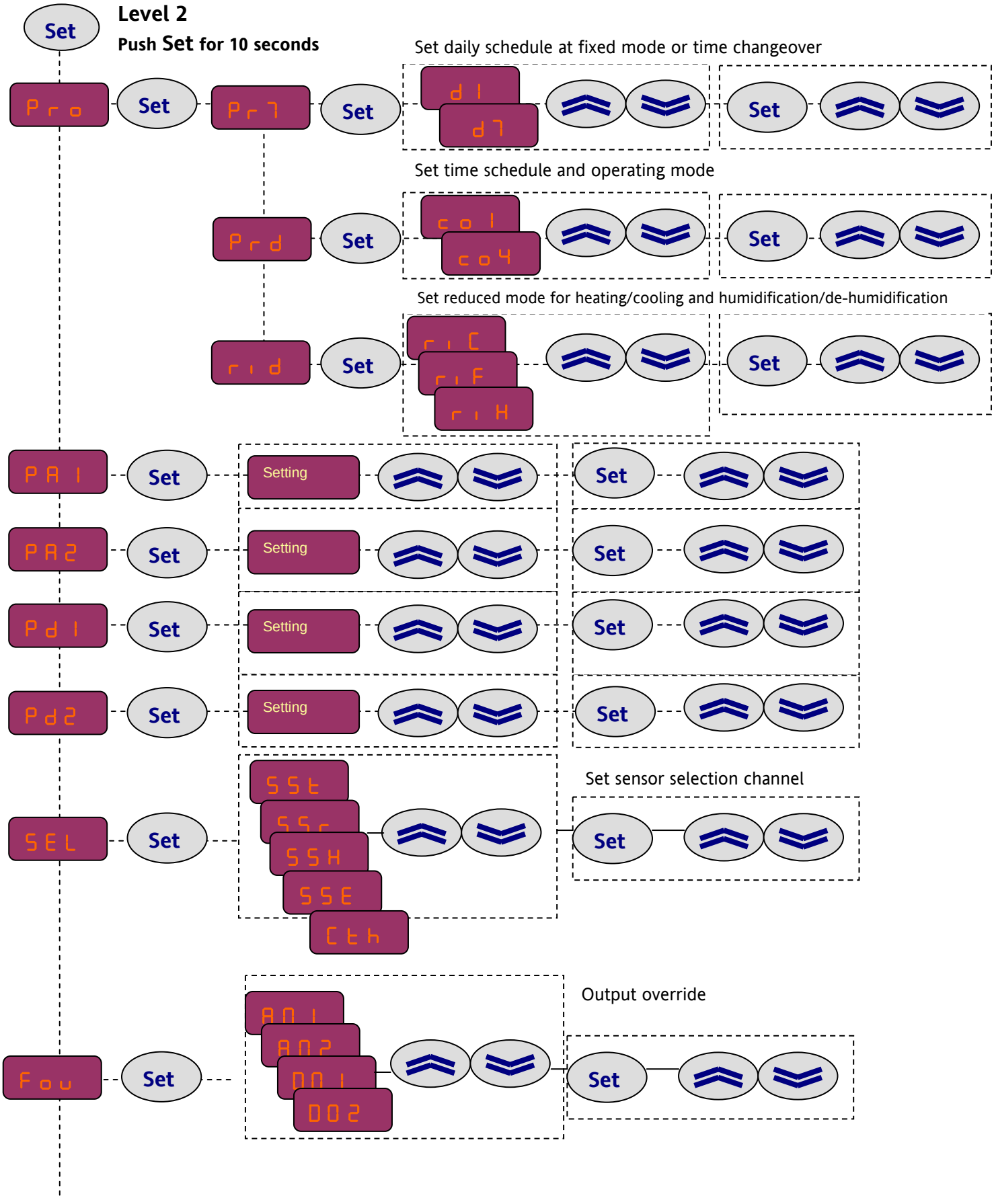



## Parameter Loop Pd2 - Mode A3

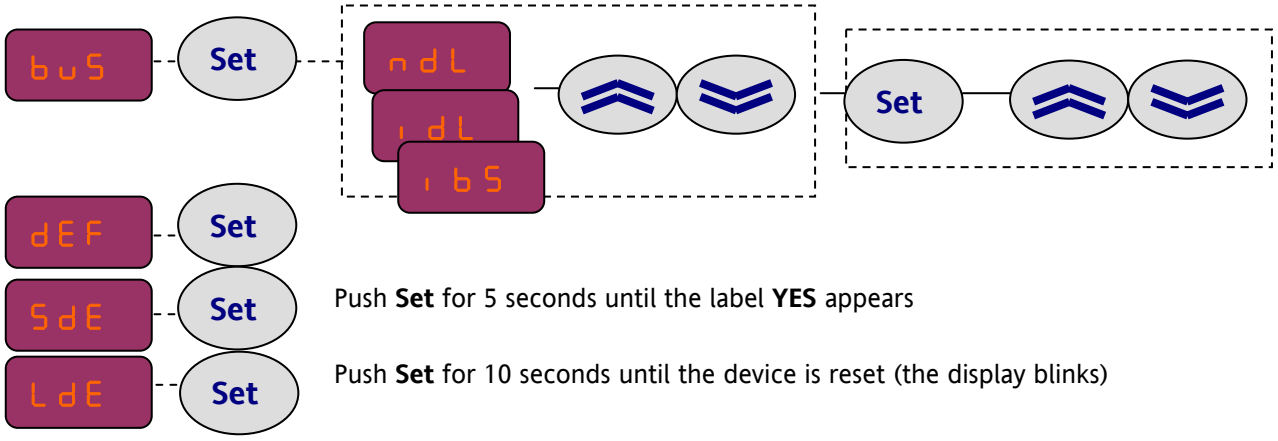
Push **Set** key to select the parameter to be modified. The parameter value blinks showing the edit status: push the **Up** and **Down** keys to change values. Once the desired values are modified, push the **Set** or **Esc** keys to exit.



## *PROGRAMME MENU FOR OPERATING MODES AND TIME SCHEDULES*



Set LinkBus and ModBus addresses



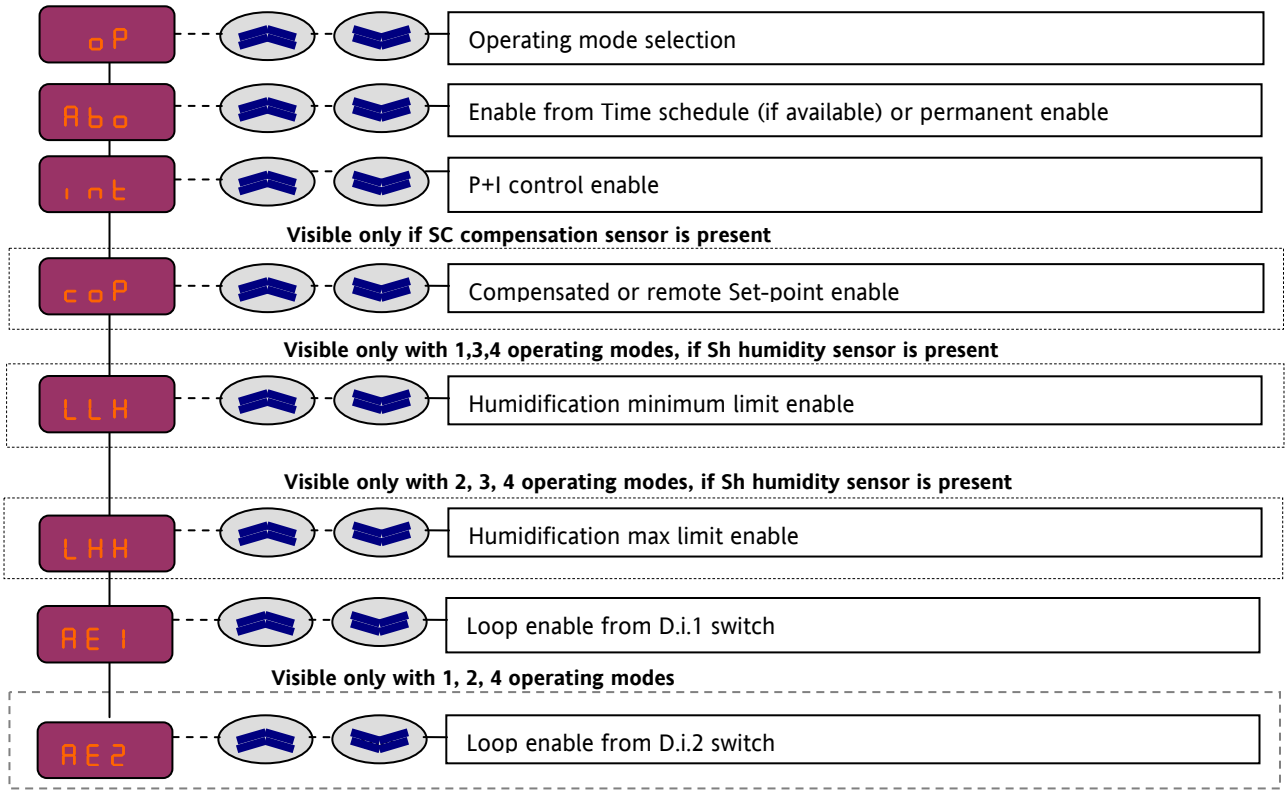

Push **Set** for 5 seconds until the label **YES** appears

Push **Set** for 10 seconds until the device is reset (the display blinks)

## Setting - Analogue output 1 / 0-10Volt PA1 Loop

Push **Set** key for at least 10 seconds to enter level 2, push **Up** key and select PA1 menu.

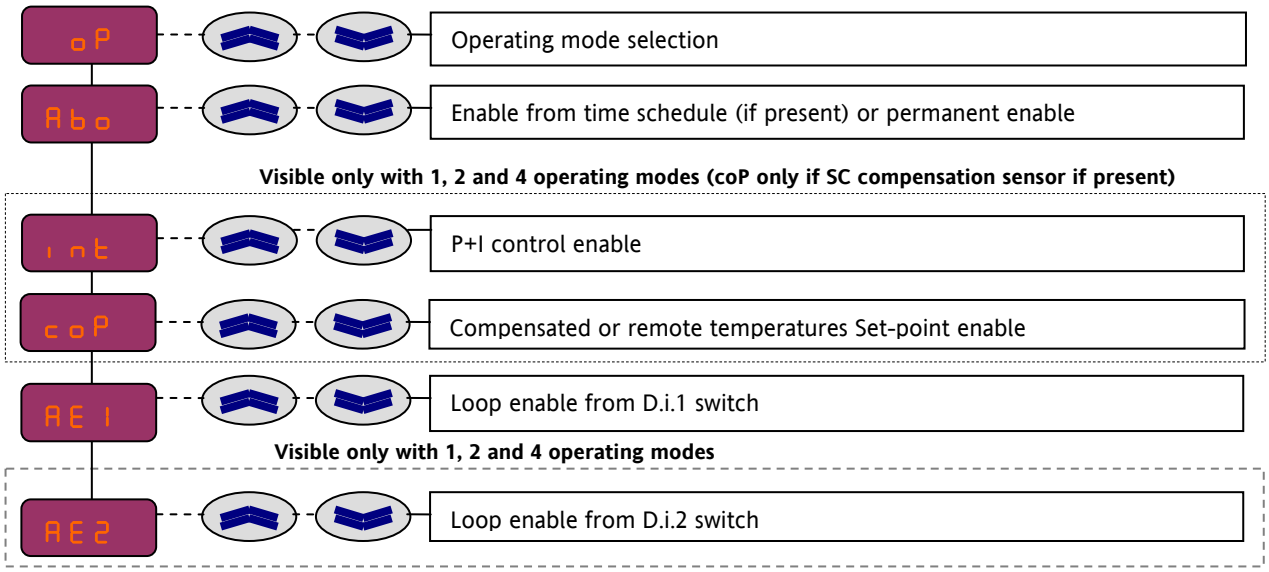
Push **Set** key to select the parameter to be modified. The parameter value blinks showing the edit status: push the **Up** and **Down** keys to change values. Once the desired values are modified, push the **Set** or **Esc** keys to exit.




## Setting - Analogue output 2 / 0-10Volt PA2 Loop

Push **Set** key for at least 10 seconds to enter level 2, push **Up** key and select PA2 menu.

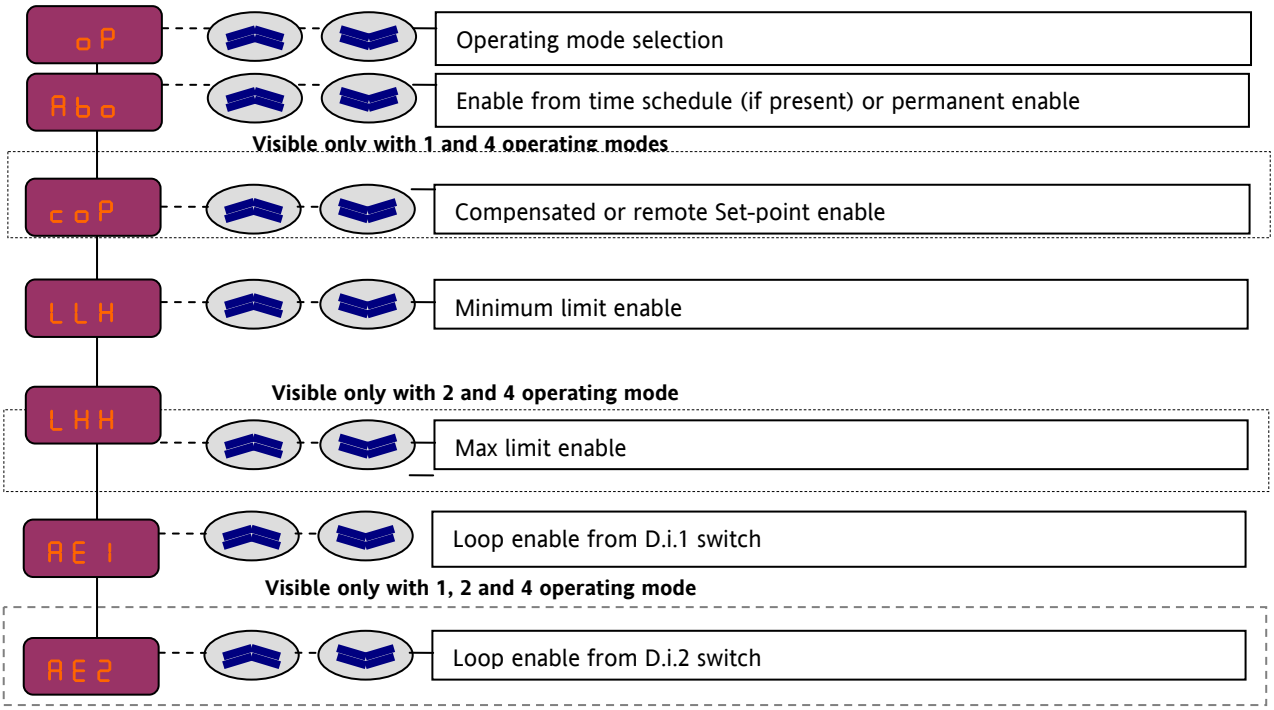
Push **Set** key to select the parameter to be modified. The parameter value blinks showing the edit status: push the **Up** and **Down** keys to change values. Once the desired values are modified, push the **Set** or **Esc** keys to exit.



## Setting - Relay Digital output 1 Loop Pd1

Push **Set** key for at least 10 seconds to enter level 2, push **Up** key and select Pd1 menu.

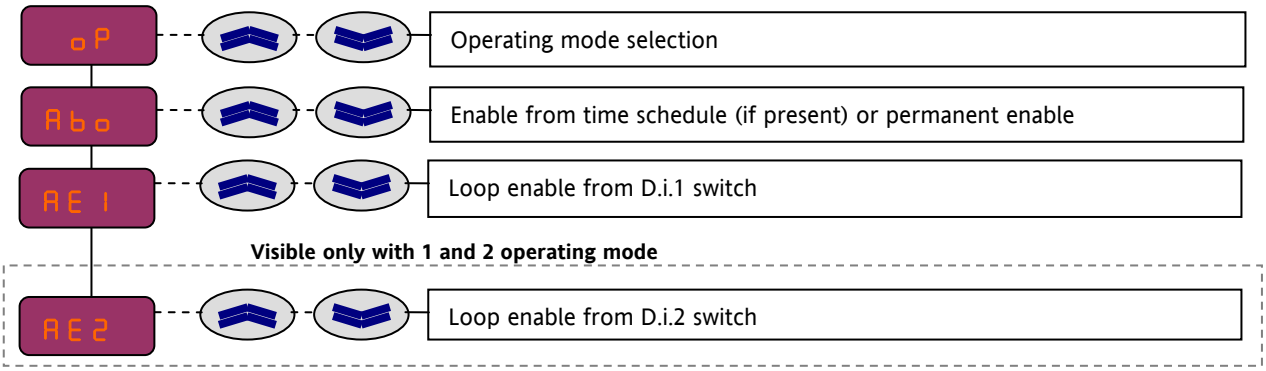
Push **Set** key to select the parameter to be modified. The parameter value blinks showing the edit status: push the **Up** and **Down** keys to change values. Once the desired values are modified, push the **Set** or **Esc** keys to exit.




## Setting - Relay digital output 2 Pd2 – 1, 2 and 3 operating mode

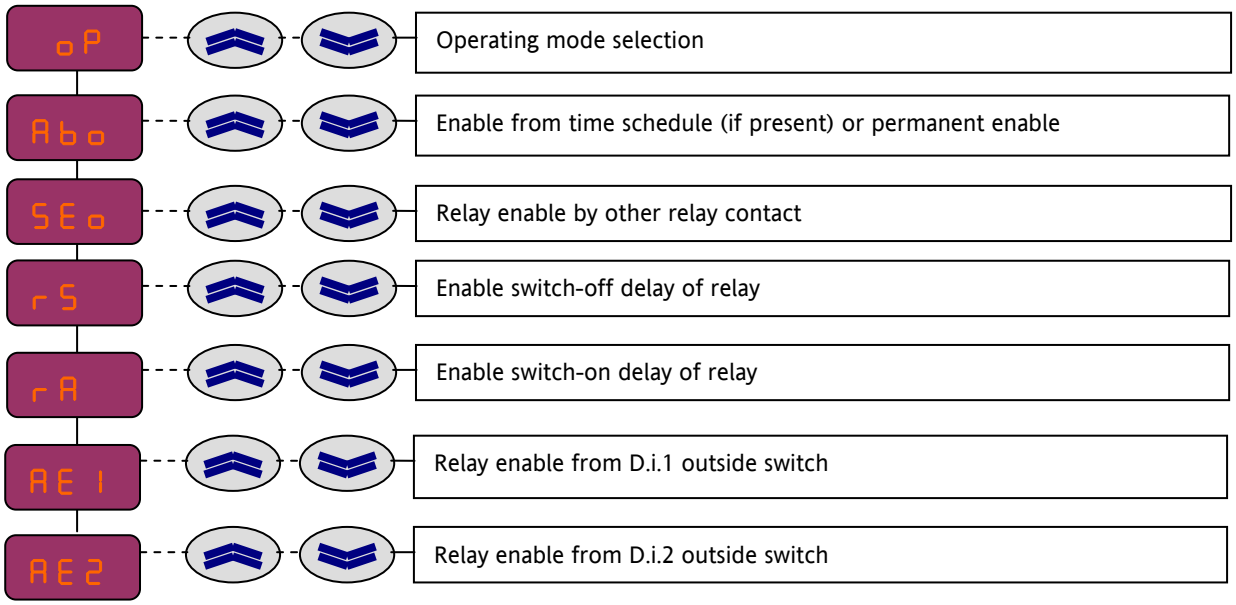
Push **Set** key for at least 10 seconds to enter level 2, push **Up** key and select Pd2 menu**.**

Push **Set** key to select the parameter to be modified. The parameter value blinks showing the edit status: push the **Up** and **Down** keys to change values. Once the desired values are modified, push the **Set** or **Esc** keys to exit.

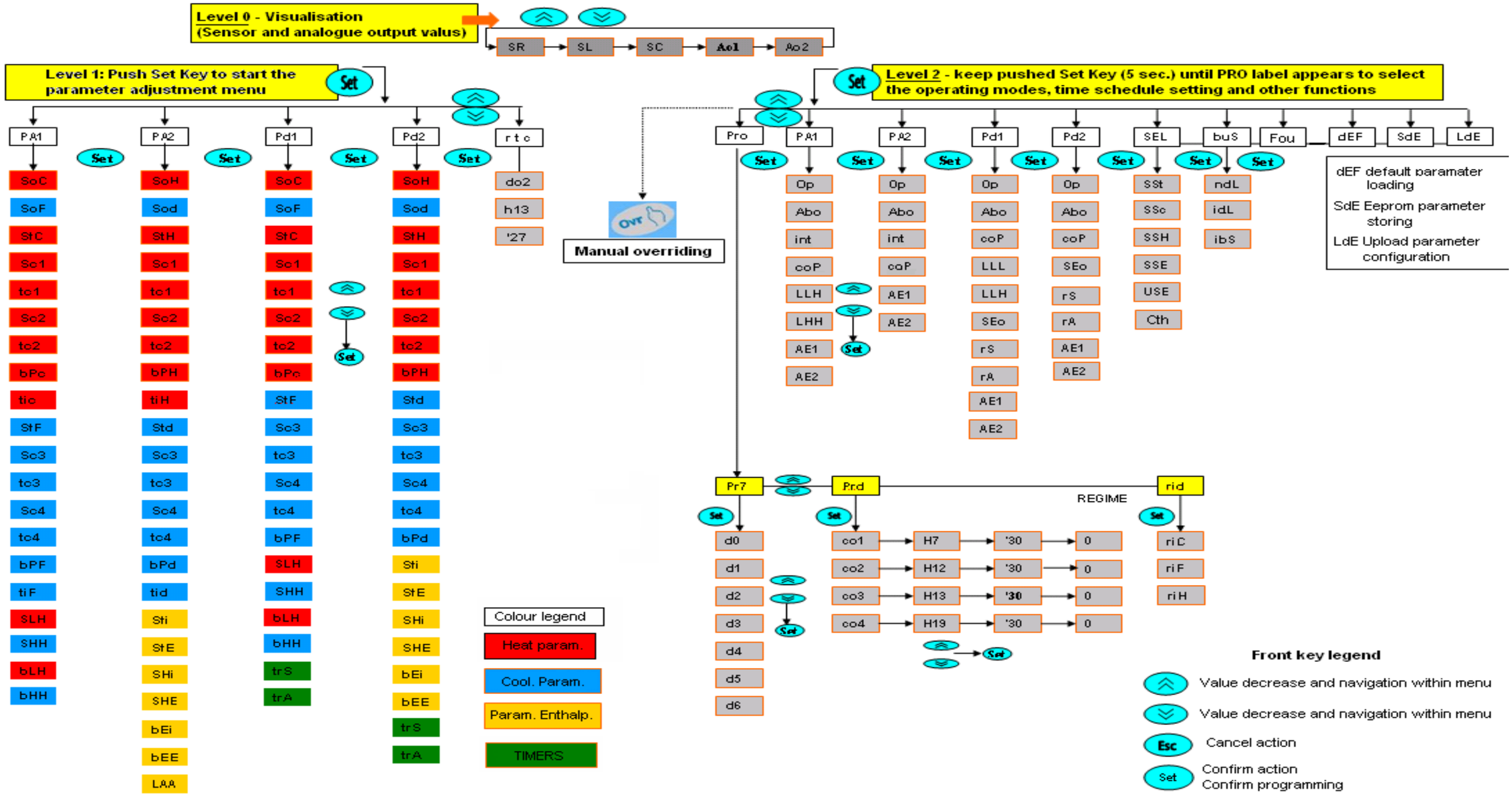


## Setting - Relay digital output Pd1 and Pd2 – 4 operating mode

Push **Set** key for at least 10 seconds to enter level 2, push **Up** key and select Pd1 and Pd2 menu**.**
Push **Set** key to select the parameter to be modified. The parameter value blinks showing the edit status: push the **Up** and **Down** keys to change values. Once the desired values are modified, push the **Set** or **Esc** keys to exit.



***MENU DIAGRAM***



## TEMPERATURE CONTROL PARAMETER TABLES (LEVEL 1)

| Analogue controller PA1 | Default | Range | Description | Availability |
|---|---|---|---|---|
| SoC | -- | | Heat operating set | Always (visualisation only cannot be set) |
| SoF | -- | | Cool operating Set | Always (visualisation only cannot be set) |
| StC | 21.0 | -50 a 150 | Heating Loop Set | With ST, without Compens., 1, 3 , 4 operating modes |
| Sc1 | 20.0 | -50 a 150 | Heating compensation minimum Set | With ST and SC, Comp.enabled.,1,3, 4 operating modes |
| c1 | 5.0 | -50 a 150 | Heating compensation minimum temperature | With ST and SC, Comp.enabled.,1,3, 4 operating modes |
| Sc2 | 35.0 | -50 a 150 | Heating compensation max Set | With ST and SC, Comp.enabled.,1,3, 4 operating modes |
| c2 | 10.0 | -50 a 150 | Heating compensation max temperature | With ST and SC, Comp.enabled.,1,3, 4 operating modes |
| tiC | 480 | 30 a 1200 | Heating integral time (sec) | With integral action enable |
| bPc | 4.0 | 0 a 25 | Heating Loop Proportional Band | With ST, 1, 3, 4 operating modes |
| SLH | 50.0 | 0 a 100 | Humidity minimum Limit Loop Set | With LLH enabled, 1, 3, 4 operating modes |
| SHH | 50.0 | 0 a 100 | Max Humidity Limit Loop Set | With LLH enabled, 1, 3, 4 operating modes |
| bLH | 4.0 | 0 a 25 | Humidity minimum limit proportional Band | With LLH enabled, 1, 3, 4 operating modes |
| bHH | 4.0 | 0 a 25 | Humidity max limit proportional Band | With LHH enabled, 2, 3, 4 operating modes |
| StF | 23.0 | -50 a 150 | Cooling Loop Set | With ST, without Compens., 2, 3, 4 operating modes |
| Sc3 | 10.0 | -50 a 150 | Cooling compensation minimum Set | With ST and SC, Comp.enabled.,2, 3, 4 operat. modes |
| c3 | 10.0 | -50 a 150 | Cooling compensation minimum temperature | With ST and SC, Comp.enabled.,2, 3, 4 operat. modes |
| Sc4 | 30.0 | -50 a 150 | Cooling compensation max Set | With ST and SC, Comp.enabled.,2, 3, 4 operat. modes |
| c4 | 15.0 | -50 a 150 | Cooling compensation max temperature | With ST and SC, Comp.enabled.,2, 3, 4 operat. modes |
| tiF | 480 | 30 a 1200 | Cooling integral time (sec) | With integral action enabled |
| bPF | 4.0 | 0 a 25 | Cooling Loop Proportional Band | With ST, 2, 3, 4 operating modes |

| On/Off controller Pd1 | Default | Range | Description | Availability |
|---|---|---|---|---|
| SoC | -- | | Heating operating Set | Always (visualisation only, cannot be Set) |
| SoF | -- | | Cooling operating Set | Always (visualisation only, cannot be Set) |
| StC | 21.0 | -50 a 150 | Heating ON/OFF Set | With ST, without Compens., 1 and 3 operating modes |
| Sc1 | 20.0 | -50 a 150 | Heating compensation minimum Set | With ST and SC, comp. enabled, 1 and 3 operat. modes |
| c1 | 5.0 | -50 a 150 | Heating compensation minimum temperature | With ST and SC, comp. enabled, 1 and 3 operat. modes |
| Sc2 | 35.0 | -50 a 150 | Heating compensation max Set | With ST and SC, comp. enabled, 1 and 3 operat. modes |
| c2 | 10.0 | -50 a 150 | Heating compensation max temperature | With ST and SC, comp. enabled, 1 and 3 operat. modes |
| bPc | 4.0 | 0 a 25 | Heating ON/OFF hysteresis | With ST, 1 and 3 operating modes |
| SLH | 50.0 | 0 a 100 | Humidity minimum ON/OFF limit Set | With LLL enabled, 1 and 3 operating modes |
| SHH | 50.0 | 0 a 100 | Humidity max ON/OFF limit Set | With LLH enabled, 2 and 3 operating modes |
| bLH | 4.0 | 0 a 25 | Humidity minimum ON/OFF limit hysteresis | With LLL enabled, 1 and 3 operating modes |
| bHH | 4.0 | 0 a 25 | Humidity max ON/OFF limit hysteresis | With LLH enabled, 1 and 3 operating modes |
| StF | 24.0 | -50 a 150 | Cooling ON/OFF Set | With ST, without Compens.,2 and 3 operating modes |
| Sc3 | 8.0 | -50 a 150 | Cooling compensation minimum Set | With ST and SC, Comp. enabled., 2 and 3 oper. modes |
| c3 | 0.0 | -50 a 150 | Cooling compensation minimum temperature | With ST and SC, Comp. enabled., 2 and 3 oper. modes |
| Sc4 | 15.0 | -50 a 150 | Cooling compensation max Set | With ST and SC, Comp. enabled., 2 and 3 oper. modes |
| c4 | 40.0 | -50 a 150 | Cooling compensation max temperature | With ST and SC, Comp. enabled., 2 and 3 oper. modes |
| bPF | 4.0 | 0 a 25 | Cooling ON/OFF hysteresis | With ST, 2 and 3 operating modes |
| trS | 0 | 0 a 1999 | Switch- off delay time (sec) | 4 operating mode |
| trA | 0 | 0 a 1999 | Switch- on delay time (sec) | 4 operating mode |

## HUMIDITY CONTROL PARAMETER TABLES (LEVEL 1)

| Analogue controller PA2 | Default | Range | Description | Availability |
|---|---|---|---|---|
| SoH | -- | | Humidification operating Set | With SH, 1 and 4 operating mode (visualised only) |
| Sod | -- | | De-humidification operating Set | With SH, 2 and 4 operating mode (visualised only) |
| StH | 50.0 | 0 a 100 | Humidification Loop Set | With SH, without Compens., 1 and 4 operating modes |
| Sc1 | 40.0 | 0 a 100 | Humidification compensation minimum Set | With SH and SC, without Comp.,1 and 4 operating modes |
| tc1 | 5.0 | -50 a 150 | Humidification compensation minimum temperature | With SH and SC, without Comp.,1 and 4 operating modes |
| Sc2 | 60.0 | 0 a 100 | Humidification compensation max Set | With SH and SC, without Comp.,1 and 4 operating modes |
| tc2 | 10.0 | -50 a 150 | Humidification compensation max temperature | With SH and SC, without Comp.,1 and 4 operating modes |
| tiH | 480 | 30 a 1200 | Humidification integral time (sec) | With integral action enabled |
| bPH | 4.0 | 0 a 100 | Humidification Loop proportional band | With SH, 1 and 4 operating modes |
| Std | 50.0 | 0 a 100 | De-Humidification Loop Set | With SH, without Comp., 2 and 4 operating modes |
| Sc3 | 40.0 | 0 a 100 | De humidification minimum compensation Set | With SH and SC, Comp. enabled., 2 and 4 oper. modes |
| tc3 | 23.0 | -50 a 150 | De humidification minimum compensation limit | With SH and SC, Comp. enabled., 2 and 4 oper. modes |
| Sc4 | 60.0 | 0 a 100 | De humidification compensation max Set | With SH and SC, Comp. enabled., 2 and 4 oper. modes |
| tc4 | 30.0 | -50 a 150 | De humidification compensation max temperature | With SH and SC, Comp. enabled., 2 and 4 oper. modes |
| tid | 480 | 30 a 1200 | De-humidification integral time (sec) | With integral action enabled |
| bPd | 4.0 | 0 a 100 | De-humidification Loop proportional band | With SH, 2 and 4 operating modes |
| Sti | 18 | -50 a 150 | Winter temperature enthalpy Set | 3 operating mode |
| StE | 23 | -50 a 150 | Summer temperature enthalpy Set | 3 operating mode |
| SHi | 55 | 0 a 100 | Winter humidity enthalpy Set | With SH and outside humidity sensor, 3 operating mode |
| SHE | 65 | 0 a 100 | Summer humidity enthalpy Set | With SH and outside humidity sensor, 3 operating mode |
| bEi | 4.0 | 0 a 25 | Enthalpy prop. band with upper inside enthalpy | 3 operating mode |
| bEE | 2.0 | 0 a 25 | Enthalpy prop. band with upper outside enthalpy | 3 operating mode |
| LLA | 10 | 0 a 100 | Minimum opening limit | 3 operating mode |

| On/Off controller Pd2 | Default | Range | Description | Availability |
|---|---|---|---|---|
| SoH | -- | | Humidification operating Set | With SH, 1 and 4 operating mode (visualised. only) |
| Sod | -- | | De-humidification operating Set | With SH, 2 and 4 operating mode (visualised. only) |
| StH | 50.0 | 0 a 100 | Humidification Loop Set | With Sh, without Compens., 1 operating mode |
| Sc1 | 40.0 | 0 a 100 | Humidification compensation minimum Set | With SH and SC, Comp. enabled., 1 operating mode |
| tc1 | 5.0 | -50 a 150 | Humidification compensation minimum temperature | With SH and SC, Comp. enabled., 1 operating mode |
| Sc2 | 60.0 | 0 a 100 | Humidification compensation max Set | With SH and SC, Comp. enabled., 1 operating mode |
| tc2 | 10.0 | -50 a 150 | Humidification compensation max temperature | With SH and SC, Comp. enabled., 1 operating mode |
| bPH | 4.0 | 0 a 100 | Humidification ON/OFF hysteresis | With SH, 1 operating mode |
| Std | 50.0 | 0 a 100 | De-humidification ON/OFF Set | With SH, without Compens., 2 operating mode |
| Sc3 | 40.0 | 0 a 100 | De humidification compensation minimum Set | With SH and SC, Comp. enabled., 2 operating mode |
| tc3 | 23.0 | -50 a 150 | De humidification compensation minimum temperature | With SH and SC, Comp. enabled., 2 operating mode |
| Sc4 | 60.0 | 0 a 100 | De humidification compensation max Set | With SH and SC, Comp. enabled., 2 operating mode |
| tc4 | 30.0 | -50 a 150 | De humidification compensation max temperature | With SH and SC, Comp. enabled., 2 operating mode |
| bPd | 4.0 | 0 a 100 | Cooling ON/OFF hysteresis | With SH, 2 operating mode |
| Sti | 18 | -50 a 150 | Winter temperature enthalpy Set | 3 operating mode |
| StE | 23 | -50 a 150 | Summer temperature enthalpy Set | 3 operating mode |
| SHi | 55 | 0 a 100 | Winter humidity enthalpy Set | With SH and outside humidity sensor, 3 operating mode |
| SHE | 65 | 0 a 100 | Summer humidity enthalpy Set | With SH and outside humidity sensor, 3 operating mode |
| bEi | 4.0 | 0 a 25 | Enthalpy prop. band with upper inside enthalpy | 3 operating mode |
| bEE | 2.0 | 0 a 25 | Enthalpy prop. band with upper outside enthalpy | 3 operating mode |
| trS | 0 | 0 a 1999 | Switch-off delay time (sec) | 4 operating mode |
| trA | 0 | 0 a 1999 | Switch-on delay time (sec) | 4 operating mode |

## *TABLES OF OPERATING MODES AND TIME SCHEDULES (LEVEL 2)*

### Time schedules: (Pro)

| Weekly schedule (Pr7) | Default | Range | Description | Availability |
|---|---|---|---|---|
| d1 (MON) | 3 | 0 to 5 | Fixed mode or daily sched.(On, rid, OFF, Pr1-2-3) | If clock is present (W500HMB model) |
| d2 (TUE) | 3 | 0 to 5 | Fixed mode or daily sched.(On, rid, OFF, Pr1-2-3) | If clock is present (W500HMB model) |
| d3 (WED) | 3 | 0 to 5 | Fixed mode or daily sched.(On, rid, OFF, Pr1-2-3) | If clock is present (W500HMB model) |
| d4 (THU) | 3 | 0 to 5 | Fixed mode or daily sched.(On, rid, OFF, Pr1-2-3) | If clock is present (W500HMB model) |
| d5 (FRI) | 3 | 0 to 5 | Fixed mode or daily sched.(On, rid, OFF, Pr1-2-3) | If clock is present (W500HMB model) |
| d6 (SAT) | 1 | 0 to 5 | Fixed mode or daily sched.(On, rid, OFF, Pr1-2-3) | If clock is present (W500HMB model) |
| d7 (SUN) | 2 | 0 to 5 | Fixed mode or daily sched.(On, rid, OFF, Pr1-2-3) | If clock is present (W500HMB model) |
| **Daily schedule (Prd)** | **Default** | **Range** | **Description** | **Availability** |
| co 1: h | 7 | 0 to 23 | Change-over time 1 | If clock is present (W500HMB model) |
| : ' | 30 | 0 to 59 | Change-over minutes 1 | If clock is present (W500HMB model) |
| : r | 0 | 0 to 2 | Change-over mode 1 (NM, RF, FA) | If clock is present (W500HMB model) |
| co 2: h | 12 | 0 to 23 | Change-over time 2 (0-23) | If clock is present (W500HMB model) |
| : ' | 30 | 0 to 59 | Change-over minutes 2 (0-59) | If clock is present (W500HMB model) |
| : r | 1 | 0 to 2 | Change-over mode 2 (NM, RF, FA) | If clock is present (W500HMB model) |
| co 3: h | 13 | 0 to 23 | Change-over time 3 (0-23) | If clock is present (W500HMB model) |
| : ' | 30 | 0 to 59 | Change-over minutes 3 (0-59) | If clock is present (W500HMB model) |
| : r | 0 | 0 to 2 | Change-over mode 3 (NM, RF, FA) | If clock is present (W500HMB model) |
| co 4: h | 19 | 0 to 23 | Change-over time 4 (0-23) | If clock is present (W500HMB model) |
| : ' | 0 | 0 to 59 | Change-over minutes 4 (0-59) | If clock is present (W500HMB model) |
| : r | 2 | 0 to 2 | Change-over mode 4 (NM, RF, FA) | If clock is present (W500HMB model) |
| **Reduced Set (rid)** | **Default** | **Range** | **Description** | **Availability** |
| RiC | 3 | 0 to 20 | Heating Set decrease | Always |
| RiF | 5 | 0 to 20 | Cooling Set decrease | Always |
| RiH | 5 | 0 to 20 | Humidity Set decrease | Always |

### Operating modes

| Analogue contr. PA1 | Default | Range | Description | Availability |
|---|---|---|---|---|
| Op | 1 | 1 to 4 | Operating mode (1, 2, 3, 4) | Always |
| Abo | OFF | | Automatic/Manual enable (Clock) | Always |
| Int | OFF | | Integral action enable | Always |
| coP | OFF | | Compensated set enable | With SC sensor |
| LLH | OFF | | Min. humidity limit loop enable | With SH sensor, 1 and 4 operating modes |
| LHH | OFF | | Max. humidity limit loop enable | With SH sensor, 1 and 4 operating modes |
| AE1 | OFF | | Loop stop on DI1 (External enable 1) | Always |
| AE2 | OFF | | Loop stop on DI2 (External enable 2) | 1, 2 and 4 operating modes. 3 Mode: S/W (off) Changeover |
| **On/Off contr. Pd1** | **Default** | **Range** | **Description** | **Availability** |
| Op | 1 | 1 to 4 | Operating mode (1, 2, 3, 4) | Always |
| Abo | OFF | | Automatic/Manual enable (Clock) | Always |
| coP | OFF | | Compensated Set enable | With SC, 1, 2 and 3 operating modes |
| LLH | OFF | | Min. (Low) ON/OFF limit enable | With SH, 1, 2 and 3 operating modes |
| LHH | OFF | | Max. (High) ON/OFF limit enable | With SH, 1, 2 and 3 operating modes |
| AE1 | OFF | | Loop stop on DI1 (External enable 1) | Always |
| AE2 | OFF | | Loop stop on DI2 (External enable 2) | 1, 2 and 4 operating mode.<br>In Mode3: S(on)/W (off) Changeover |
| SEo | OFF | | Other ON/OFF control enable | Operating mode 4 |
| RS | OFF | | Switch off delay enable | Operating mode 4 |
| RA | OFF | | Switch on delay enable | Operating mode 4 |

| Analogue contr. PA2 | Default | Range | Description | Availability |
|---|---|---|---|---|
| Op | 3 | 1 to 4 | Operating modes (1, 2, 3, 4) | Always |
| Abo | OFF | | Automatic/Manual enable (Clock) | Always |
| Int | OFF | | Integral action enable | Always |
| coP | OFF | | Compensated set enable | With SC sensor |
| AE1 | OFF | | Loop stop on DI1 (External enable 1) | Always |
| AE2 | OFF | | Loop stop on DI2 (External enable 2) | 1, 2 and 4 operating modes. 3 Mode: S/W (off) Changeover |

| On/Off contr. Pd1 | Default | Range | Description | Availability |
|---|---|---|---|---|
| Op | 1 | 1 to 4 | Operating mode (1, 2, 3, 4) | Always |
| Abo | OFF | | Automatic/Manual enable (Clock) | Always |
| coP | OFF | | Compensated Set enable | With SC, 1, 2 operating modes |
| AE1 | OFF | | Loop stop on DI1 (External enable 1) | Always |
| AE2 | OFF | | Loop stop on DI2 (External enable 2) | 1, 2 and 4 operating mode.<br>In Mode3: S(on)/W (off) Changeover |
| SEo | OFF | | Other ON/OFF control enable | 4 Operating mode |
| rS | OFF | | Switch off delay enable | 4 Operating mode |
| rA | OFF | | Switch on delay enable | 4 Operating mode |

| Special Functions Sensor selection (SEL) | Default | Range | Description | Availability |
|---|---|---|---|---|
| SSt | 1 | | Temperature control sensor selection | Always |
| SSc | 1 | | Compensation sensor selection | Always |
| SSH | 1 | | Humidity control sensor selection | Always |
| SSE | 1 | | Selection for sensor outside the device | Always |
| USE | OFF | | Compensation sensor enable by ModBus | Always |
| Cth | Ct | Ct Ch | Compensation sensor selection | Always |

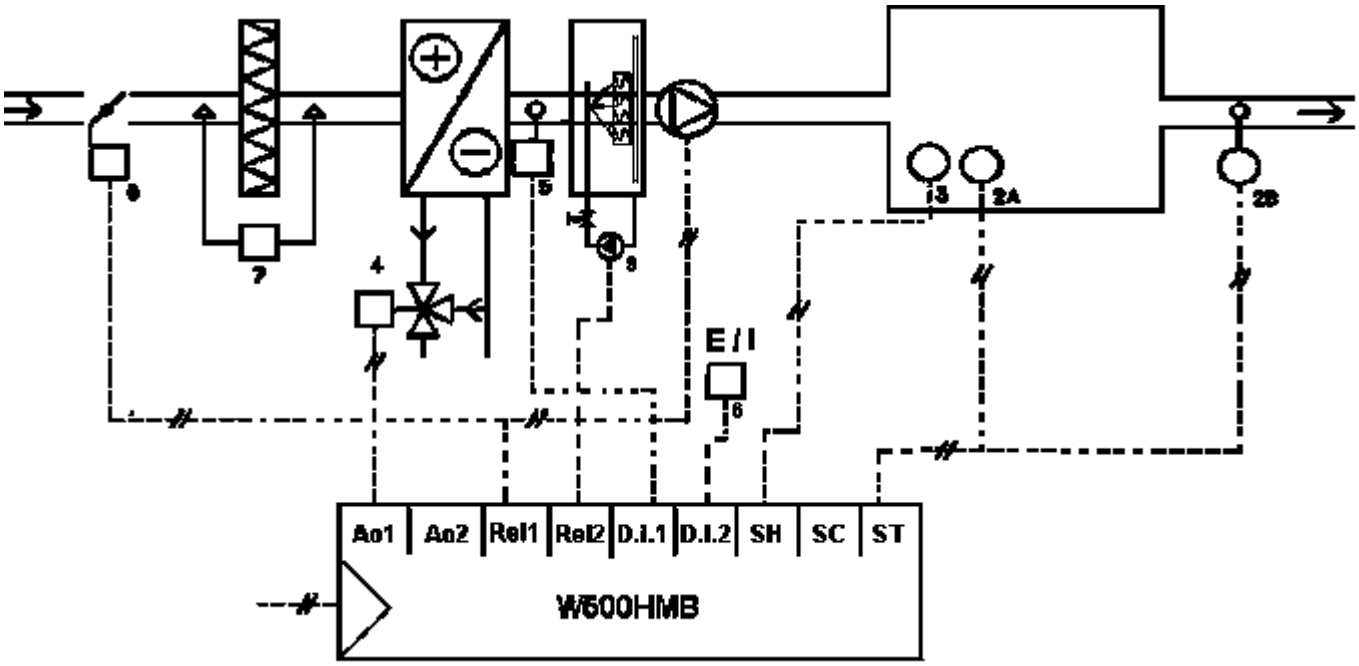
| Communication (buS) | Default | Range | Description | Availability |
|---|---|---|---|---|
| ndL | 1 | 1 to 4 | Number of devices on LinkBus (1 - 4) | Always |
| idL | 1 | 1 to 4 | LinkBus position (1 - ndL) | Always |
| ibS | 1 | 1 to 255 | ModBus Supervisor bus address | Always |

| Output override Fou | Description |
|---|---|
| A01 | Auto, ON, OFF output override |
| A02 | Auto, ON, OFF output override |
| D01 | Auto, ON, OFF output override |
| D02 | Auto, ON, OFF output override |

# SYSTEM APPLICATIONS

**EXAMPLE 1:**
**OUTSIDE AIR PLANT WITH S/W TIME CONTROL OF ROOM TEMPERATURE AND ON/OFF WINTER HUMIDIFICATION**

Proportional temperature controller, heating/cooling changeable by D.i.2. with outside compensation, and on/off humidity control + limit control (anti-frost or max temperature) on any of D.i.1 digital inputs. “Configurable” start-up of two relays on hysteresis or control.




**OPERATION**

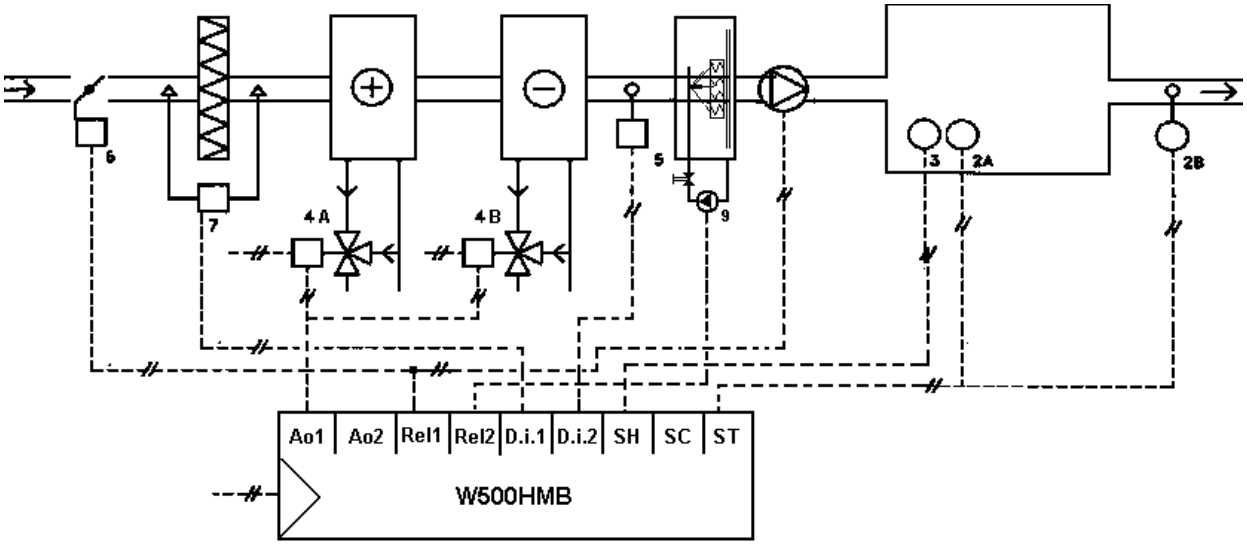
The controller carries out time control, with PI action, on room temperature (A2 sensor) or on air exhaust (2B sensor) by driving the valve (4) on heating/cooling coil.
It controls “direct” action (summer) or “reverse” action (winter) depending on changeover (6) as per digital input D.i.2.
In winter time, room humidity (transmitter 3) is kept above or equal to the set point value through on/off humidification (9). ModBus supervision is possible.
**Frost protection:** in case of heated fluid lack or of faulty control, if the anti-frost thermostat (5) detects a temperature lower than the set value, the controller stops the fan and closes the outside air damper.
**Obstructed filter**: the pressure switch (7) signals the presence of obstructed filter if the differential pressure before and after the filter, increases over the set value.
**Possible variants**:
Remote set-point of heating/cooling coil on SC input or outside compensated set-point with sensor on SC input. On the controller, only in summer mode, in the temperature control loop, can be enabled the function “max humidity limit” on the proportional valve (4) according to the 0-100% signal given by SH input (Humidity transmitter), to the set-point and humidity limit value set.
If the request of cooling due to limit loop (de-humidification) is higher than that one for temperature, the controller will give priority to the request of de-humidification (the limit signal is predominant), by cooling more in order to condensate more humidity on supply
It is possible to have a proportional humidifier where, instead of the Rel2 digital output connected to on/off humidifier, the Ao2 analogue output is considered as connected to a proportional humidifier.

**EXAMPLE 2**:

**OUTSIDE AIR PLANT WITH HEATING/COOLING ROOM TEMPERATURE TIME CONTROL AND ON/OFF HUMIDIFICATION**

A heating-cooling sequence with optional compensation, using the two analogue outputs having (on request) limit action (anti-frost or max temperature) on any of the digital inputs, on/off humidification.

Configuration mode facilities of two relays.




**OPERATION**

The PI controller carries out time control on room temperature (A2 sensor) or on air ejection (2B sensor) by driving in sequence heating (4A) and cooling (4B) batteries valves with 1-5 and 6-9 Volt range.

The room humidity (transmitter 3) is maintained at the set point by on/off control on the humidifier (9). ModBus supervision is possible**.**

**Frost protection:** in case of heated fluid lack or faulty control, if the anti-frost thermostat (5) detects a temperature lower than the set value, the controller stops the fan and closes the outside air damper.

**Obstructed filter**: the pressure switch (7) signals the presence of obstructed filter if the differential pressure before and after the filter, increases over the set value.

**Possible variants**:

Remote set-point of heating coil on SC input or outside compensated set-point with sensor on SC input. The function “max humidity limit” is activated on the proportional valve (4) depending on 0-100% signal given by SH input (Humidity transmitter), on set-point and humidity limit values set.

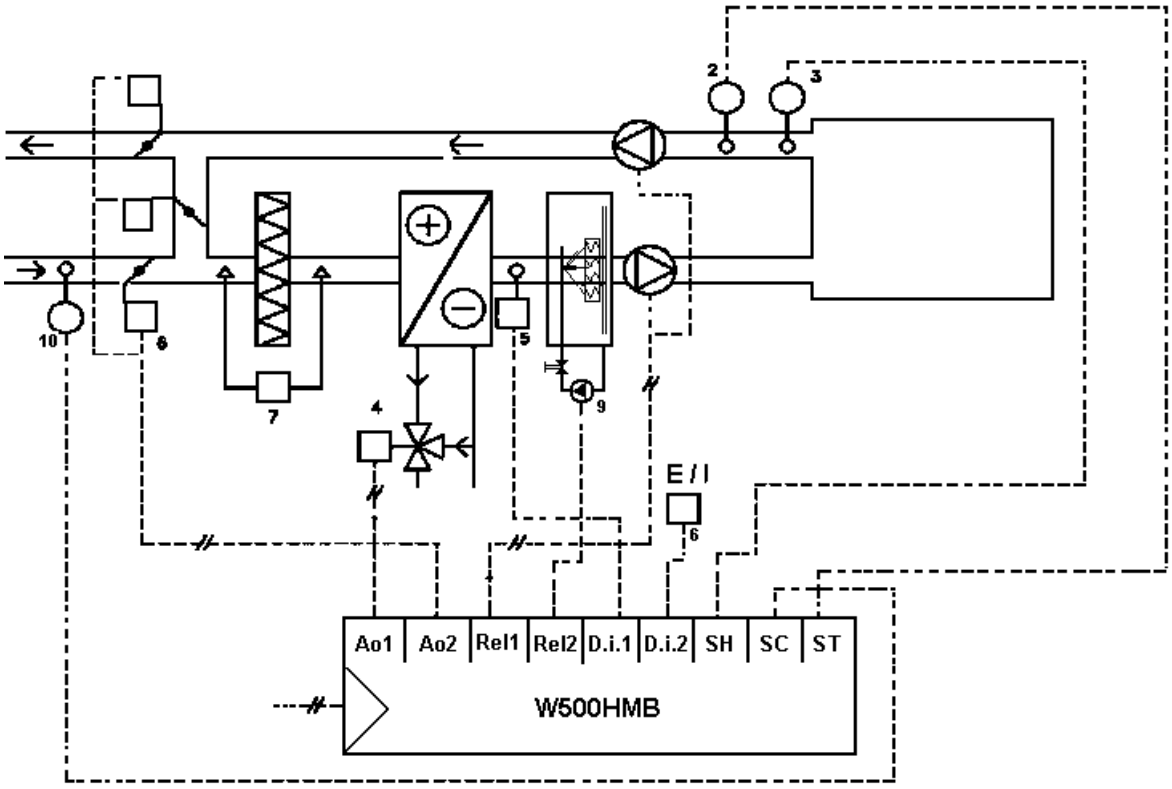
If the cooling request due to limit loop (dehumidification) is higher than that one for temperature, the controller will give priority to the request of cooling (the loop limit signal is predominant), by cooling more in order to condensate more humidity on supply.

It is possible to have a proportional humidifier where, instead of the Rel2 digital output connected to on/off humidifier, the Ao2 analogue output is considered as connected to a proportional humidifier.

In this case it is possible also humidification/de-humidification sequence by connecting in parallel both the proportional humidifier and the cooling valve 4B to output Ao2.

**EXAMPLE 3**:
**RETURN AIR SYSTEM WITH DAMPER MANAGEMENT ONLY FOR TEMPERATURE, ROOM TEMPERATURE AND HUMIDIFICATION**

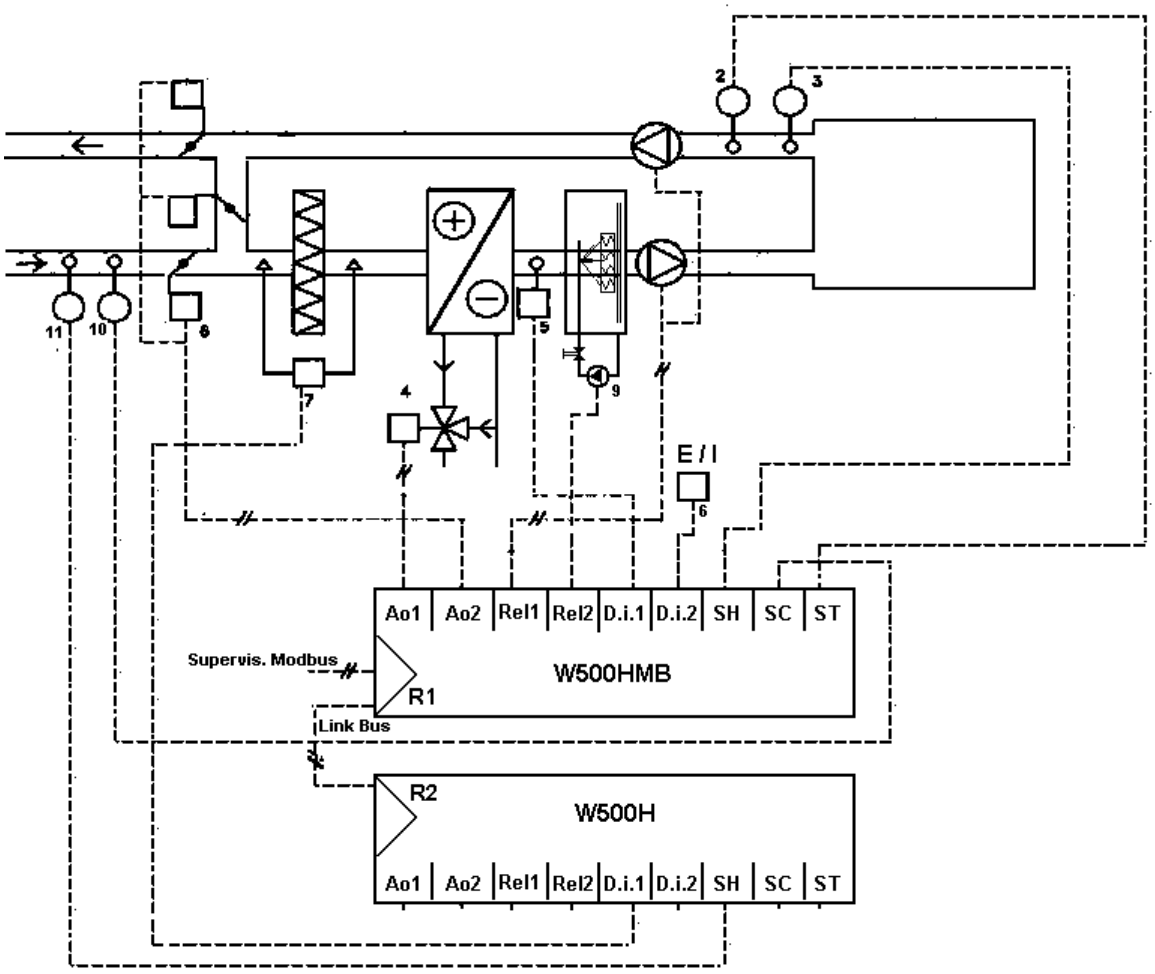
In a return air system, the differential comparison between outside and inside temperature to control dampers, room temperature control with cooling/heating batteries + limit function (anti-frost or max temperature) on any digital input.




***OPERATION***
The controller carries out time control, by PI action, on room temperature on return (2 sensor), by driving the valve (4) on heating/cooling coil. It controls with “direct” action (summer) or “reverse” action (winter) depending on the changeover (6) read on digital input D.i.2. In winter time, room humidity (transmitter 3) is maintained at the set point value through On/Off humidification (9).
Outside air dampers (inlet and exhaust) and the return air damper are driven with only one analogue output and the apposite direct/reverse set concerning the relevant actuators (outside max opening = minimum return air). If the outside temperature (sensor 10) is lower than inside one (2 sensor) and it is winter time, the inside air will have priority giving the possibility of minimum opening. Vice versa in summertime.
ModBus supervision is possible.
**Frost protection:** in case of heated fluid lack or of faulty control, if the anti-frost thermostat (5) detects a temperature lower than the set value, the controller stops the fan and closes the outside air and air-exhaust damper and contemporarily opens the of return air damper.
**Obstructed filter**: the pressure switch (7) signals the presence of obstructed filter if the differential pressure before and after the filter, increases over the set value.
**Possible Variants:** outside compensated set on SC sensor for heating/cooling loop (Ao1).
In summertime, in the control loop, the “Max Humidity limit” function is started on proportional valve (4) depending on 0-100% signal coming from SH input (Humidity transmitter) and on set and proportional band of humidity limit set. If the cooling request due to limit loop (de-humidification) is higher than the temperature one, the controller will give priority to the de-humidification request, by cooling more in order to condensate more humidity on supply.

**EXAMPLE 4**:
**RETURN AIR SYSTEM WITH ENTHALPY DAMPER CONTROL, ROOM TEMPERATURE AND HUMIDIFICATION**

**Enthalpy damper control: <u>THIS APPLICATION REQUIRES TWO W500H</u>**
Return air system with differential comparison of two Enthalpies (outside/inside) for damper control, room temperature control with heating/cooling coil + limit function (anti-frost or max temperature) on any of digital inputs.

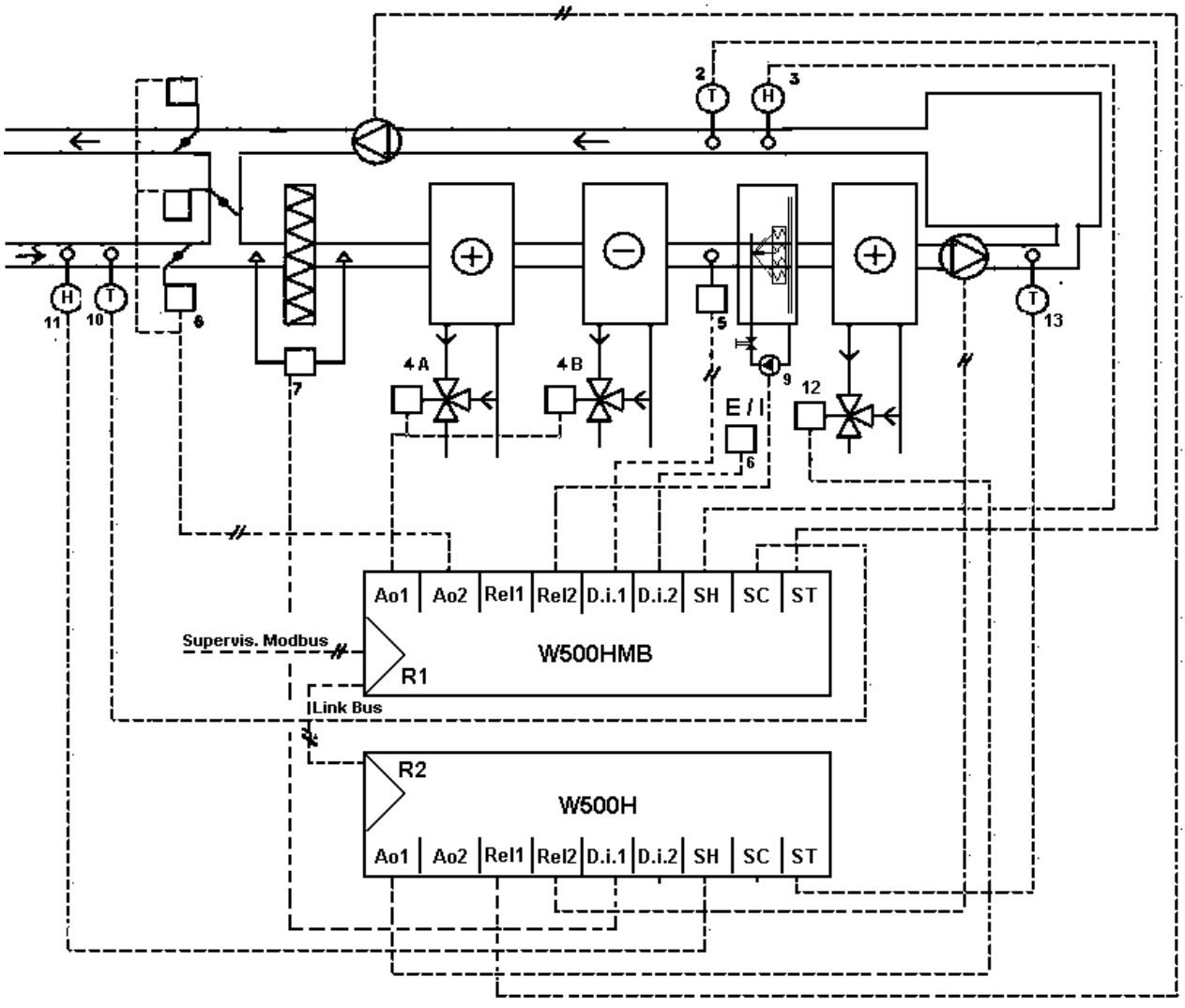



***OPERATION***
The R1 controller time controls, with PI action, the room temperature on return air (sensor 2) driving the valve (4) on heating/cooling coil. It controls “Direct” (Summer) or “Reverse” (Winter) action depending on S/W changeover (6), from digital input DI2.
In winter time, the room humidity detected by transmitter (3) is maintained at set point by on/off action of humidifier (9). The outside dampers (inlet and exhaust) and the return air one are controlled by one analogue output only and by setting the correct direct/reverse action of the relevant actuators (max outside opening=minimum return air system).
If the outside Enthalpy (detected by outside temperature sensor (10) and outside humidity transmitter (11)) is higher than the internal one (return air temperature sensor (2) and return air humidity transmitter (3)) , in winter outside air has priority and vice versa in summer. R1 controller receives the information about outside humidity percentage via LinkBus, through the R2 controller. ModBus supervision is possible.
**Frost protection:** in case of heated fluid lack or of faulty control, if the anti-frost thermostat (5) detects a temperature lower than the set value, the controller stops the fan and closes the outside air and air-exhaust damper and contemporarily opens the return air damper.

**Obstructed filter**: the pressure switch (7) signals, to R2 controller, the presence of obstructed filter if the differential pressure before and after the filter, increases over the set value. This information is sent to supervisor via LinkBus and controller R1.
**Possible Variants:** set-point of heating/cooling loops (Ao1 output) compensated by outside air temperature sensor connected to SC input, or remote set-point by potentiometer. In summertime, in the control loop, the function “max humidity limit” is enabled on proportional valve (4) depending on 0-100% signal, coming from SH of R1 humidity transmitter and on the adjusted set and humidity limit proportional band.
If the cooling request due to limit loop (de-humidification) is higher than that the temperature one, the controller will give priority to the de-humidification request (the limit loop signal is prevailing), by cooling more in order to condensate more humidity on supply. Possible management of both proportional and on/off post-heating on the R2 controller Loop. It is possible to carry out direct control of room humidity through proportional humidifier.
It is possible to manage separately the return air fan with switch-on delay, with respect to the supply air fan on R2 controller. It is possible to use the remaining unused loop functions of R2 controller.

**EXAMPLE 5**:
**AIR HANDLING UNIT WITH RETURN AIR AND ENTHALPY CONTROL OF DAMPERS**

**Enthalpy damper control: <u>THIS APPLICATION REQUIRES TWO W500H</u>**
This application is an extension of the example 4, where more functions of R1 controller are performed.



***OPERATION***

R1 Controller time controls with PI action the outside temperature on return air sensor (2) driving valve (4) on heating (4A) and cooling (4B) batteries. It carries out control by driving on the same output of two actuators (one set as “reverse” 1-5 Vdc, the other as “direct” 6-9 Vdc) with output at 5.5 Vdc when the set is satisfied. Room humidity supplied by the transmitter (3) is maintained above/equal to set point by on/off humidification (9).

The outside dampers (inlet and exhaust) and supply air damper are driven by only one analogue output and by the apposite direct/reverse set of the relevant actuator (Max Outside opening = Min return air) or with proper leverage. If the outside Enthalpy (outside air temperature sensor (10) and outside humidity transmitter (11)) is higher than the internal one (Return air temperature sensor (2) and return air humidity transmitter (3)) the controller will give priority to outside air in winter and vice versa in summer.

R1 controller receives the information about outside humidity percentage via LinkBus through controller R2.

Moreover, the R2 controller provides the control of summer supply temperature through post-heating valve/coil (12) and supply air sensor (13).

It is possible a separate control of return air fan with switch on delay with respect to the supply air fan on R2 controller, in order to avoid over-loading in electric supply at AHU start-up.

ModBus supervision is possible.

**Frost protection:** in case of heated fluid lack or of faulty control, if the anti-frost thermostat (5) detects a temperature lower than the set value, the controller stops the fan and closes the outside air and air-exhaust dampers and contemporarily opens the return air damper.

**Obstructed filter**: the pressure switch (7) signals, to R1 controller, the presence of obstructed filter if the differential pressure before and after the filter, increases over the set value. This information is sent to the supervision via LinkBus.

**Possible Variants:** set-point of heating/cooling loops (output Ao1) compensated through outside temperature sensor connected to SC input, or remote set-point from potentiometer.

It is possible to have a proportional humidifier connected to A02 output of R2 controller.

It is possible to have a remote set on post-heating drive.

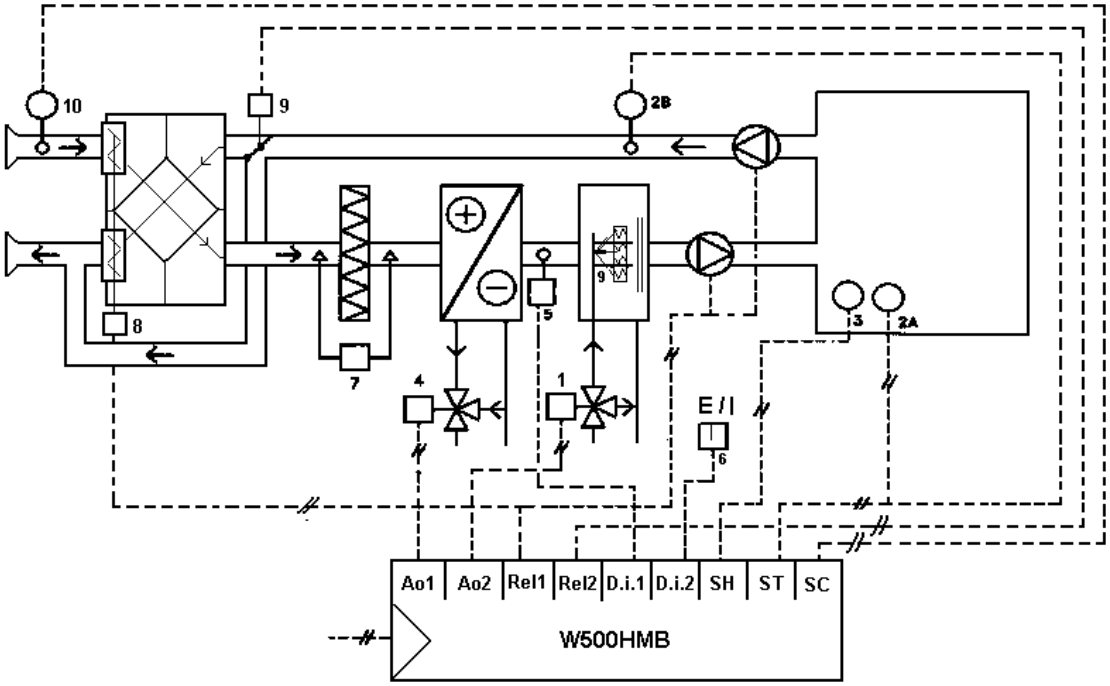
It is possible to have thermal contact detection on unused R2 digital input, or possible alarm signalling activation on R2 through unused relays.

For all variants, where the three analogue inputs are not available, there is the possibility of limit or of compensation on the signal transmitted by another controller via LinkBus.

**EXAMPLE 6**

**OUTSIDE PLANT WITH STATIC RECUPERATOR S/W TIME CONTROL FOR ROOM TEMPERATURE AND PROPORTIONAL HUMIDIFICATION**

Proportional temperature controller with heating/cooling sequence or S/W changeover, with outside temperature compensation and proportional humidity control. Summer start-up of bypass damper recuperator when the inside temperature condition is unfavourable.




***OPERATION***

The controller time controls, with PI action, the room temperature (sensor A2) or on air exhaust (sensor 2B) by driving the valve (4) on the heating/cooling coil with outside compensated set-point with sensor (10) on SC input. It is possible to control “Direct” (summer) or “Reverse” (winter) function depending on S/W changeover (6), coming from digital input D.i.2 .

In winter mode, the room humidity (transmitter 3) is maintained at set-point through proportional humidification by driving the valve (1). In summer time, when inside temperature exceeds the outside one, the static recuperator is by-passed by driving the damper (9) to avoid the recovery of exceeding heating or, vice versa, if the inside temperature is lower than the outside one.

Limit action (anti-frost or max temperature) on D.i.1 digital input.

Fan start-up with stroke end switch of inlet and air-exhaust dampers (8) in order to avoid cavitation phenomena. The obstructed filter contact can be inserted in series with FA (5) contact to improve protection.

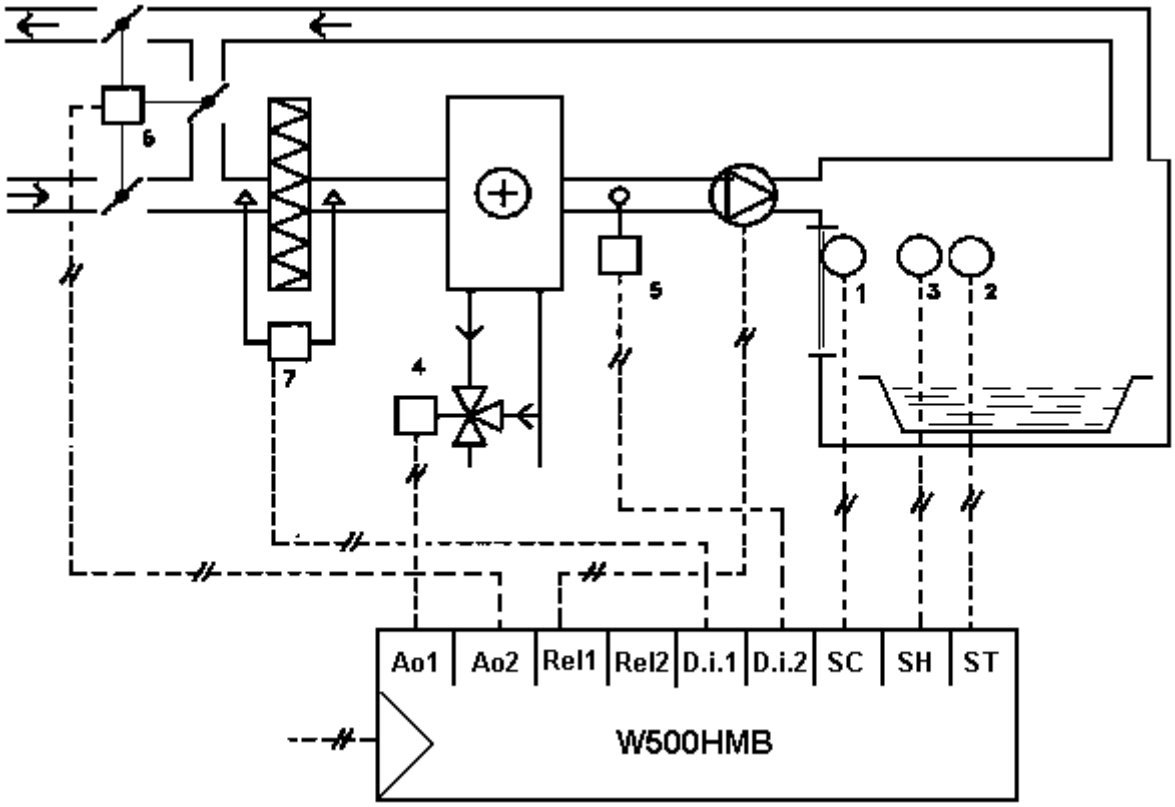
ModBus supervision is possible.

**Frost protection:** in case of heated fluid lack or of faulty control, if the anti-frost thermostat (5) detects a temperature lower than the set value, the controller stops the fan and closes the outside air damper.

**Obstructed filter**: the pressure switch (7) signals, to R2 controller, the presence of obstructed filter if the differential pressure before and after the filter, increases over the set value.

**Possible Variants:** In summer mode only, in the thermal control loop, it is enabled the function max humidity limit on proportional valve (4) depending on the 0-100% signal coming from SH input (humidity transmitter) and of the adjusted set and humidity limit proportional band. If the request of cooling due to limit loop (de-humidification) is higher than the temperature one, the controller will give priority to the request of de-humidification (the limit loop signal is prevailing), by cooling more in order to condensate more humidity on supply.

**EXAMPLE 7:**
**RETURN AIR SYSTEM WITH MODULATING CONTROL OF ROOM TEMPERATURE AND HUMIDITY IN INDOOR SWIMMING POOLS.**
Time controller of heat proportional temperature and proportional humidity control with outside air variation. Compensation of supply air mixing with glass wall sensor in order to avoid condensation phenomena.




***OPERATION***
The controller time controls, with PI action, the room temperature through sensor (2) by driving the valve (4) on the heating coil. Room humidity control by drier outside air supply which is introduced indoor after being heated by the heating coil in order to reduce humidity. Through the room humidity sensor (3) the damper controller (6) ensures that only the outside air, necessary to maintain the desired humidity set-point, is introduced.
The humidity set-point is compensated by sensor (1) placed on swimming pool glass walls and connected to SC input. When inside temperature of the glass wall surface, due to low outside temperature, decreases up to the condensate value of room humidity, the compensation reduces linearly the set-point of room humidity avoiding condensate phenomena. Limit action (anti-frost or max temperature) on D.i.1 digital input.
ModBus supervision is possible.
**Frost protection:** in case of heated fluid lack or of faulty control, if the anti-frost thermostat (5) detects a temperature lower than the set value, the controller stops the fan by closing the outside air damper.
**Obstructed filter**: the pressure switch (7) signals the presence of obstructed filter if the differential pressure before and after the filter, increases over the set value.
**Possible Variants:** it is possible to use a cooling coil of on/off condensation on output Rel2 to increase the humidification when the outside air is wet.